Petroleum Processing

INCLUDING PETROCHEMICAL SECTION

JUNE, 1955

BEATING ZERO WEATHER — *Dakota gasoline plant shows how* . . . p. 846

WHEN OCTANES BREAK 100 — How will we measure engine knock? . . . . . p. 837

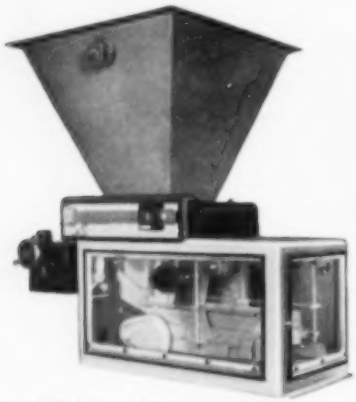
WORK LOAD PROBLEMS? — Try variable contract maintenance . . . . . p. 860

SIZE IS NO BAR — Smaller refiners CAN make petrochemicals . . . . . p. 871

A McGRAW-HILL PUBLICATION

B-I-F METERS FEEDERS CONTROLS

for the PETROLEUM industry



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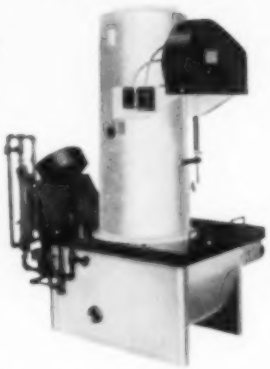

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Petroleum Processing

Covering petroleum and petrochemical research and the design, construction, management, operation and maintenance of plants processing hydrocarbon materials into fuels lubricants and chemicals

June, 1955
Vol. 10, No. 6

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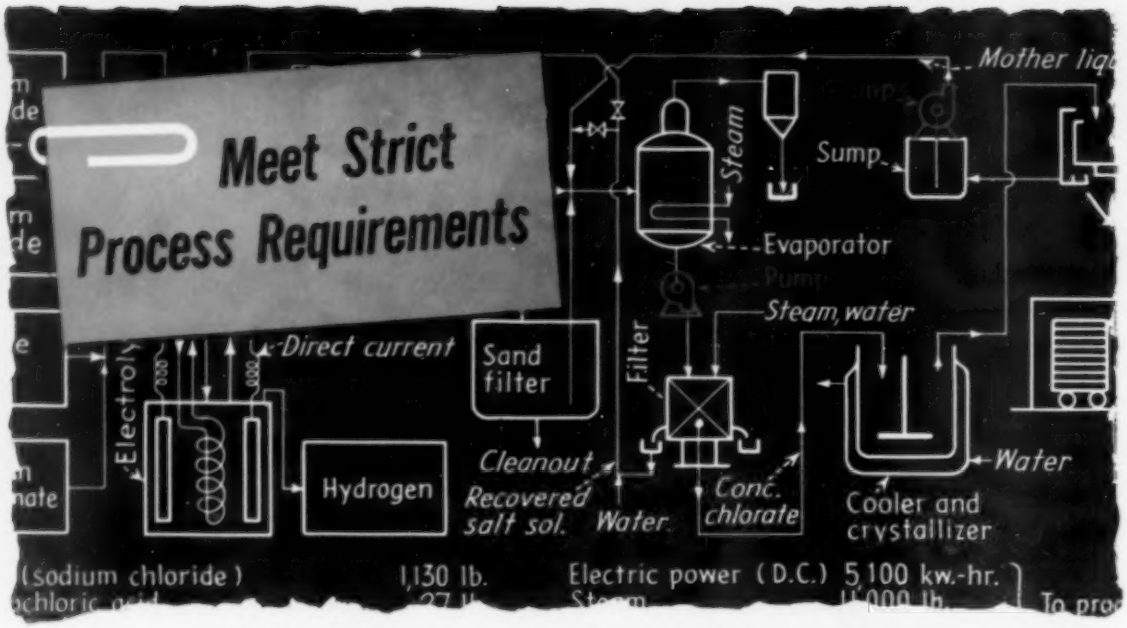
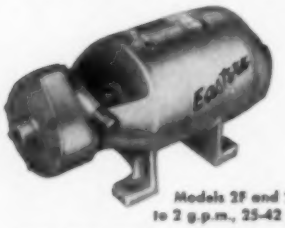


. . . with Eastern Centrifugal Pumps



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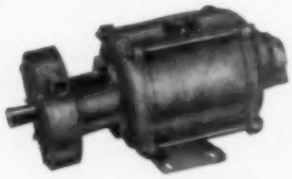

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to 17 g.p.m., to 17 p.s.i.

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(To obtain more data on advertised products see page 916)

Petroleum Processing

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Publisher's Page

We Haven't Lost an Editor Yet

PUTTING together a story for PETROLEUM PROCESSING is a lot more than pounding a typewriter. Before you can do that you need some facts. And the story behind the gathering of those facts is frequently about as interesting reading as the story itself.

As a case in point, I refer you to the "Letter" from Dave Thornton, our Southwestern Editor, on p. 783 in this issue. Dave's trials and tribulations in traveling from the pleasant warmth of Houston to the frigid cold of Billings, Mont., to get an on-the-spot story of the first commercial Fluid Coking unit (also in this issue, pp. 840-45) are a little more than we normally require of an editor. But they demonstrate quite clearly, I think, the kind of service our staff gives us every day —and the kind of thinking that goes into the editing of PETROLEUM PROCESSING.

It is frequently a lot easier to sit at a desk and work over the press releases. They usually give you a moderate amount of information—but they don't answer your questions, and they don't impart that "feeling" for a plant which you get when you actually tramp around it. We much prefer to get our story on a new plant or unit by going to see it ourselves and talking with the guys who live with it.

I'm not trying to tell you that there's a motto over our editorial desks saying something like "Nothing is too good for our readers!" You'd probably say "hog wash" (or something equally inelegant—only more so). And to some extent you'd be quite correct, because just as you don't treat your product to remove the last trace of sulfur when the specs permit 0.1%, neither do we spend extra time and effort to get a fancy, above-specification story if the one we can get with less trouble is good and worth using. We're just as practical as you are.

But we're also practical enough to realize that you, the reader, are our customer, and that if we don't satisfy you and give you worthwhile, helpful, and interesting material in PETROLEUM PROCESSING, then you won't bother to read the magazine. And if you don't read it, you're not likely to renew your subscription when it expires. That we wouldn't like. So you'll find that we're always sending out editors all over the country to dig up the facts for those stories we think particularly important—and which we believe can't be obtained just as well in some easier manner.

Lest you start worrying about our mortality rate after reading Dave's letter, we haven't lost an editor yet—neither through accident nor lack of fortitude.

William F. Bland

Editor

Other McGraw-Hill Petroleum Publications

National Petroleum News
The monthly oil marketing magazine, covering news, prices, transportation, storage, merchandising.

Platt's Oilgram News Service
A daily independent oil-news reporting service issued from New York, Chicago and Houston.

Platt's Oilgram Price Service
A daily independent oil-price reporting service issued from New York, Chicago and Houston.

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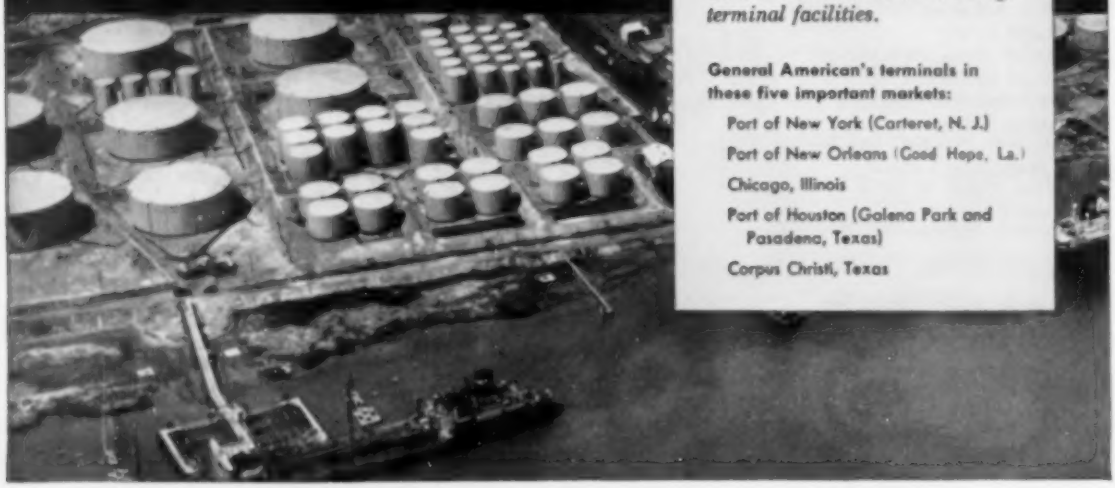
Chicago, Illinois
Port of Houston (Galena Park and Pasadena, Texas)
Corpus Christi, Texas



What's Happening

in Refining

. . . **Commerce Oil Refining Corp.,** newly-formed affiliate of Commerce Oil Corp. of Warren, Pa., will start construction in fall of a new 30,000 b/d refinery on a 500-acre tract near Providence, R. I., at Arnold's Point, with completion planned for early in 1957. Crude supplies are expected to be imported from Middle East. Plant design is being handled by Lummus Co.

. . . **Standard Oil Co. (Ohio)** will build an 11,000 b/d Ultraformer at its Cleveland No. 1 refinery, with completion scheduled for 10 or 11 months. Total cost is estimated at $4,400,000; and a $2,000,000 contract has been awarded Fluor Corp. for engineering and purchase of equipment.

. . . **American Oil Co.** has awarded a contract to The Lummus Co. for engineering, design, and construction of a delayed-coking unit of undisclosed capacity at its new Yorktown, Va. refinery.

. . . **Shell Oil Co.** will add a new 16,000 b/d Platforming unit and a hydrodesulfurization unit of the same capacity at its Houston refinery. Procon, Inc. has construction contract, with completion scheduled for early 1956.

. . . **Leonard Refineries Inc.** is installing a 3500 b/d Ultraformer and a 5200 b/d Hydrofining unit (catalytic desulfurization) at Alma, Mich., with completion scheduled for October 1. Contracts are held by Ralph M. Parsons Co. and the J. F. Pritchard & Co.

. . . **Excelsior Refineries Ltd.** has awarded joint contract for construction of its new 2000 b/d plant at Dawson Creek, B. C., to B. D. Bohna and Co. Ltd., Vancouver, and E. V. Lane Corp., Palo Alto., Calif. Completion is planned by November 30.

. . . **Standard Oil Co. of California** has selected Sand Island at the entrance to Honolulu harbor as the site for its $30,000,000 refinery in Hawaiian Islands, providing area of some 200 acres.

. . . **Imperial Oil Ltd.** will start construction next fall of a $4,500,000 plant at Sarnia, Ont., to turn out a new petroleum wax, "first of its kind in the world." With completion scheduled for January, 1957, capacity will be 35,000,000 lb/yr.

. . . **Carter Oil Co.** has started construction of a new 6900 b/d Hydrofiner and a 2500 b/d catalytic reformer at Billings, Mont., with completion planned by January, 1956. Fluor Corp. has the contract for the project.

. . . **New construction projects** approved for fast tax write-offs recently include the following:

Big West Oil Co. of Montana, $583,400 for a 650 b/d catalytic reformer and a 1000 b/d catalytic hydrogenation unit at Kelvin, Mont.

Phillips Petroleum Co., $101,000 for sulfur removal facilities from 7142 b/d of mixed butanes at natural gasoline plant, Phillips, Tex.

Warren Petroleum Co., $1,814,303 for a 1525 b/d natural gasoline plant in Wise County, Tex.

Warren Petroleum Co., $628,680 for expansion of Monument, N. Mex., natural gasoline plant to produce an additional 4000 b/d of LPG products.

Skelly Oil Co., $250,000 for an isobutane fractionator and treater at Eunice, N. Mex., to recover 310 b/d of isobutane.

Salt Lake Refining Co., $282,000 for jet fuel and avgas blending and testing facilities at Salt Lake City, Utah.

Pennzoil Co., $850,000 for refining facilities at McClintock, Pa.

Sinclair Refining Co., $295,000 for refining facilities at Houston, Texas.

in Petrochemica's

. . . **Escambia Bay Chemical Corp.,** a subsidiary of United Gas Corp. of Shreveport, La., has begun construction of a new $30,000,000 plant near Pensacola, Fla., for production of anhydrous ammonia and nitrogen compounds, with completion scheduled for early in 1956.

. . . **Foster Grant Co., Inc.,** will expand production at its Baton Rouge styrene monomer plant to over double existing capacity, to 50,000,000 lb/yr.

. . . **Nine bids were received on unsold** government copolymer rubber plant at Baytown, Texas, by close of bidding period, Rubber Producing Facilities Disposal Commission reported. Bidders are: American Resinous Chemicals, Baytown Rubber & Chemical, Food Machinery & Chemical, General Tire & Rubber, Goodyear Synthetic Rubber, Minnesota Mining & Mfg., Thiokol Chemical, United Carbon, and Edwin W. Pauley. Negotiations must be completed in 60 days.

. . . **Spencer Chemical Co.** has announced a $1,500,000 expansion in nitric acid and ammoniating solutions at its Vicksburg, Miss., plant, with completion for spring, 1956.

. . . **Phillips Chemical Co.** has begun construction of a new unit to produce polyethylene at its Adams Terminal works on the Houston Ship Channel near Pasadena, Texas, and a 145,000,000 lb/yr. ethylene plant at the Phillips Petroleum Co. refinery near Sweeny, Texas.

. . . **Gonzalez Chemical Industries, Inc.,** will build a $12,250,000 plant at Guanica, Puerto Rico, to make 42,000 ton/yr of anhydrous ammonia from residual oil, which it plans to buy on open market. Part of the anhydrous will be converted to aqua ammonia and ammonium salts.

. . . **Socony Mobil Oil Co. Inc.** and Sharples Chemicals Inc. have made licensing agreement granting Sharples rights to manufacture and sell thiophene under Socony Mobil patents. Made from butane and sulfur, thiophene will be in production by mid-summer at new plant in Houston operated by Index Chemicals Co., a subsidiary of Pennsylvania Salt Mfg. Co., who also is parent firm to Sharples.

. . . **Hidalgo Chemical Co.** (formerly Carthage Hydrocol, Inc.) expects to complete rehabilitation and testing of main units at Brownsville, Texas, oil-from natural gas plant this year. Design capacity calls for about 180,000,000 lb/yr of chemicals and 5300 b/d gasoline and fuel oils.

Company has received fast tax write-off approval on $3,428,000 for following process facilities additions: synthesis gas generator, catalyst activation facilities, and related units.

. . . **Ethyl Corp.** has received a fast tax write-off approval for a $4,000,000 chemical "intermediates" plant at Baton Rouge, La.

in Foreign Operations

. . . **The Texas Co.** plans to build a 20,000 b/d refinery in Cuba, with completion scheduled by Jan. 1, 1957. Company has taken options on possible site near Santiago.

. . . **Iraq Government Oil Refineries** Administration has signed contract with Foster Wheeler Ltd. for $10,400,000 for construction of lubricating oil plant of 25,000 ton/yr. capacity, with construction to begin this fall. Aim is to eliminate lube oil imports.

. . . **Compania Commercial Vacuum S. A.,** an affiliate of Socony Mobil Oil Co. Inc., has agreed with Petroleos Mexicanos on election by Compania Commercial of a $1,000,000 lube oil compounding plant, using stock from Pemex' Salamanca refinery. Capacity is estimated at 200,000 bbl/yr; completion by end of 1955.

. . . **Greek Minister of Economic Coordination** has signed an agreement with Hydrocarbon, a German firm, for construction of a 26,000 b/d refinery at Astropyrgos, near Athens, with completion scheduled in two years. Plant will include an 8200 b/d Atlantic Refining Co. licensed catalytic reformer.

. . . **Neste Oy Corp.,** Finland government-owned, has awarded Lummus Co. construction contract for 18,000 b/d refinery near Turku, at estimated total cost of $17,000,000.

in Markets and Prices

. . . **The contra-seasonal pinch in heavy fuel** supplies highlighted May's oil market picture. Gasoline showed good early-season strength, distillate fuels slid toward their usual summer slump, but the heavy fuel situation surprised marketers all across the country.

Residual prices were firm to higher throughout the nation, as high demands from the booming heavy industries and reluctance of most suppliers to increase imports combined to make for short supplies. Oklahoma No. 6 prices, the best indicator of the mid-Continent heavy fuel picture, rose 0.5¢ to $1.60 bbl., and some spot No. 6 moved for $1.70 and more.

At the Gulf, low sulfur bunker oil was swapped for ordinary material plus 15¢/bbl., and traders said even ordinary No 6 was on the verge of going "premium."

At New York, No. 6 was so tight that one refiner-marketer reached to California for about 20 cargoes for summer shipment. This material will lay down at New York for around $2.60 bbl. as against mid-May New York barge price of $2.35.

. . . **Gasoline prices rose in several areas** as the heavy consumption season started. Continental Oil Co. hiked tank wagon prices 0.4¢ gal. in the Rocky Mountain states. Standard of Indiana increased prices in amounts ranging from 0.3 to 1¢ gal. throughout the Midwest, and Ohio Standard boosted its postings 0.7 to 1¢.

. . . **Start of the long, dry summer season** for the distillate fuels was marked by "summer-fill" plans in the East, and lower prices at the Gulf. Esso Standard cut kerosine, No. 2 fuel, and diesel oil prices 0.15¢ to 0.2¢ gal. in the northern part of its marketing area, and also applied a "voluntary allowance" of 0.5¢ gal. to resellers and consumers. At the Gulf, No. 2 fuel prices dropped 0.5 to 0.825¢ gal. for cargo lots, and traders said even the lower price was subject to "shading."

in Transition

. . . **Deep Rock Oil Co.** has disposed of its remaining refining, marketing and pipe line facilities to Kerr-McGee Oil Industries, Inc. for $17,000,000 of preferred stock, plus substantial oil payment for undeveloped leases.

Deep Rock is transferring to K-M $5,000,000 cash and $12,000,000 in assets. A cancellable lease Deep Rock had retained on the Cushing, Okla. refinery it sold to General American Oil Co. last July has also been transferred to the Kerr firm.

. . . **Ethyl Corp.** has formed a subsidiary, Ethyl Corp. of Canada Ltd., to construct and operate the new antiknock plant planned at Sarnia, Ont.

. . . **Stockholders have approved merger of Sunray** Oil Corp. and Mid-Continent Petroleum Corp., to form new Sunray Mid-Continent Oil Co. New firm expects to spend $50,000,000 for new facilities this year, it is reported.

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THE LUMMUS COMPANY, 385 MADISON AVENUE, NEW YORK 17, N. Y.

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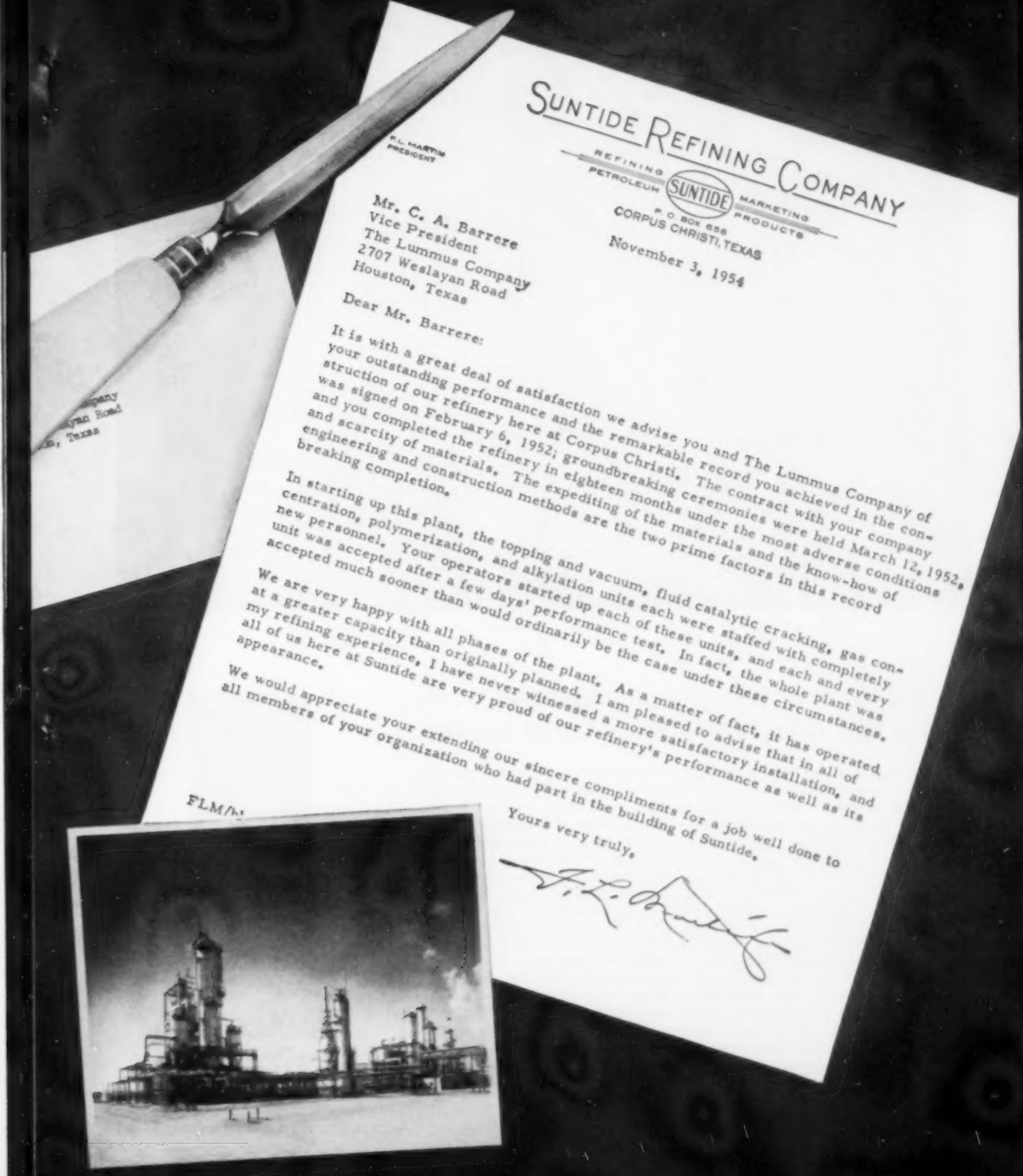


SUNTIDE REFINING COMPANY

REFINING PETROLEUM SUNTIDE MARKETING PRODUCTS

P. L. MARTIN
PRESIDENT

P. O. BOX 656
CORPUS CHRISTI, TEXAS

November 3, 1954

Mr. C. A. Barrere
Vice President
The Lummus Company
2707 Weslayan Road
Houston, Texas

Dear Mr. Barrere:

It is with a great deal of satisfaction we advise you and The Lummus Company of your outstanding performance and the remarkable record you achieved in the construction of our refinery here at Corpus Christi. The contract with your company was signed on February 6, 1952; groundbreaking ceremonies were held March 12, 1952, and you completed the refinery in eighteen months under the most adverse conditions and scarcity of materials. The expediting of the materials and the know-how of engineering and construction methods are the two prime factors in this record breaking completion.

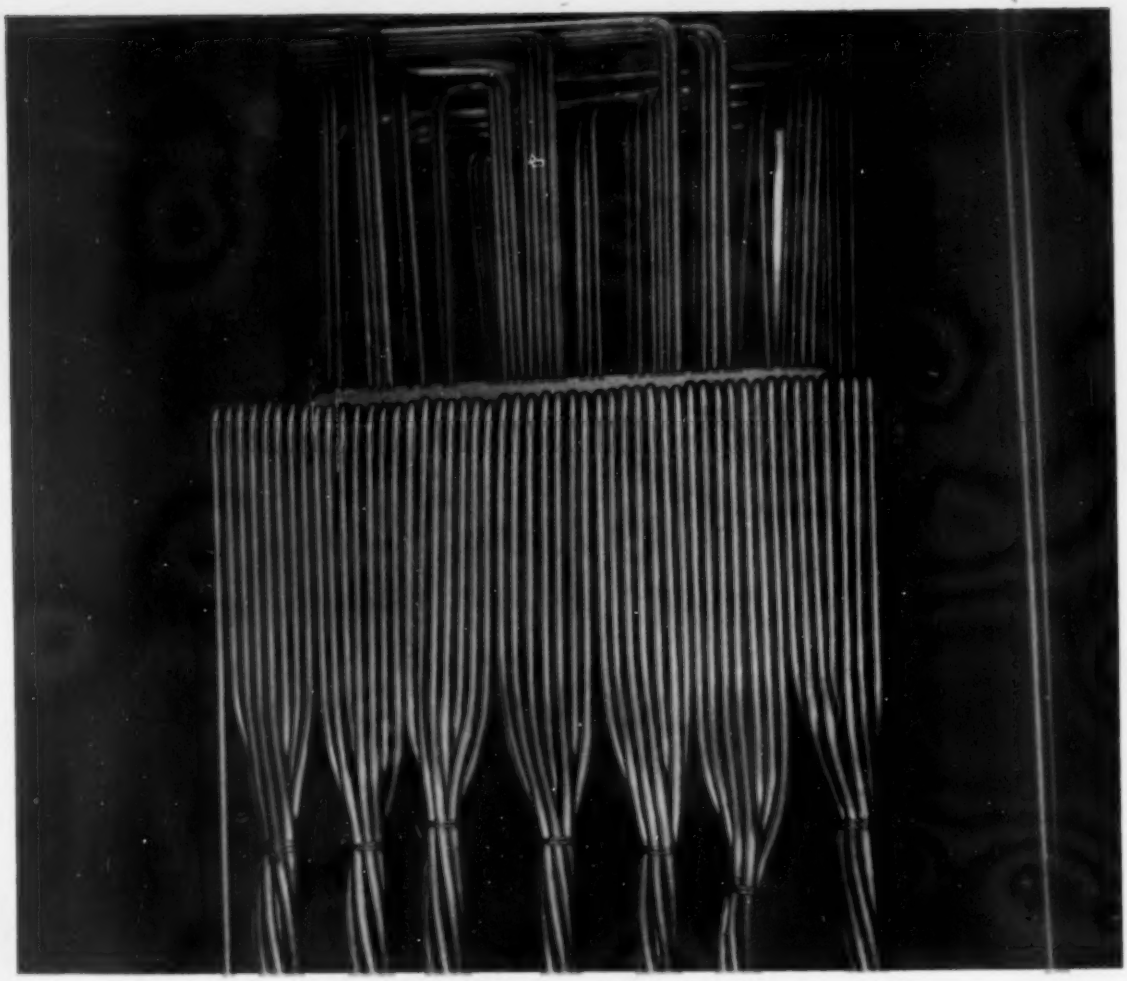
In starting up this plant, the topping and vacuum, fluid catalytic cracking, gas concentration, polymerization, and alkylation units each were staffed with completely new personnel. Your operators started up each of these units, and each and every unit was accepted after a few days' performance test. In fact, the whole plant was accepted much sooner than would ordinarily be the case under these circumstances.

We are very happy with all phases of the plant. As a matter of fact, it has operated at a greater capacity than originally planned. I am pleased to advise that in all of my refining experience, I have never witnessed a more satisfactory installation, and all of us here at Suntide are very proud of our refinery's performance as well as its appearance.

We would appreciate your extending our sincere compliments for a job well done to all members of your organization who had part in the building of Suntide.

Yours very truly,

FLM/b:



Cabled copper instrument tubing installed at Appalachian Electric Power Company's Kanawha River Station. You see it at the point where the cable divides for run-outs to instruments. Note smooth, short-radius bends.

108,000 feet of cabled copper instrument-control tubing helps keep Kanawha River Power Station humming

Hundreds of air-actuated instruments are an important part of the instrumentation control network at the 430,000-kw Kanawha River Station of the Appalachian Electric Power Company — part of the American Gas and Electric System. The size of the plant called for instrument tubing runs of up to 1,000 feet — with tubing cabled in bundles. For economical stranding, the tubing was needed in unusual lengths – without joints. To conserve space, small diameter tubing was needed. And ability to take short-radius bends without pinching was necessary.

The 108,000 feet of Anaconda Seamless Copper Tubing was supplied in 1,000-feet lengths. Outside diameter was only ¼-inch, wall thickness only .030". Shown above are typical tube bundles as they near terminal connections.

Anaconda small-bore, thin-wall tubing is available in lengths up to 2,400 feet. It comes in long coils on reels, or cut to your requirements. Capillary tubes, restrictor tubes, Bourdon tubes, special shapes, and fabricated tubes and parts for refrigeration and air-conditioning are available in many different alloys. These include phosphorized and OFHC copper, the full range of brasses, 3,003 aluminum, nickel silvers, and certain special alloys. For more information about Anaconda small-bore tubes and special shapes ask any district sales office, or write direct to *The American Brass Company, Waterbury 20, Connecticut.* In Canada: *Anaconda American Brass Ltd., New Toronto, Ontario.*

Some of the many sizes and shapes of Anaconda Small-diameter Tubes.

ANACONDA®
SMALL DIAMETER TUBES

A Lighter-Than-Kerosine Fuel For Commercial Jet Aircraft?

FROM an analysis of current technological and economic factors, two authorities with Phillips Petroleum Co. suggest that a naphtha product of 250-400°F. boiling range may turn out to be ultimate selection of the airlines in this country for commercial gas turbine fuel. They point out, however, that much more work will have to be done on turbo-engines in actual operation before "an optimum commercial fuel can be defined completely".

These conclusions were presented in a report given before the recent Aeronautic Meeting of the Society of Automotive Engineers, in New York.(1) The Phillips technologists point out that, notwithstanding the lower price therm (100,000 Btu) for the heavier distillate fuels, evidence is not yet available to show whether their disadvantages, such as higher freezing points, possibly lower payloads and poorer combustion characteristics outweigh the lower cents/therm. While refinery kerosine will continue in good commercial availability, there are many grades that do not fully meet present aviation kerosine specifications, it is stated, and where segregated storage and handling facilities would be necessary to supply a satisfactory product to the airlines.

The best performance compromise, they believe, is a "heart-cut" JP-4 product, or "roughly the hydrocarbons boiling between 250 and 400°F." This material would more readily meet the low freezing point requirements, would not involve the weight penalty of kerosine or heavier fuels, would offer advantages over kerosine with respect to combustion, and would probably be equivalent to kerosine in respect to minimum variations in fuel supplied throughout an airline route."

In considering the availability of such a fuel, possible competitive applications must be emphasized, the Phillips report brings out. "An important factor would be the virgin charge stock requirements of cat-crackers and reformers used to maximize high octane motor fuel yields per barrel of crude. Of specific interest to anyone considering the heavy naphthas for aviation . . . is the advantage of catalytically reforming the straight-run heavy naphtha to obtain 98 octane number premium fuel. This suggests that a 250-400°F. straight-run naphtha would have a value (for aircraft fuel) equivalent to its value for motor fuel, minus the losses and cost involved in reforming." At current market prices this is reported as 10-11 ¢ gal. on the Gulf Coast.

Among the present well defined products commercially available, the report brings out, if ordinary kerosine, diesel fuel and light heating oils are not suitable as now marketed, Military JP-4 is the most available fuel for airline use. "This will obviously be the case during wartime, when demand for the middle-of-the-barrel fuels will be so acute that it will be necessary to maximize jet fuel production at the expense of motor fuels."

Refiners might in part meet the demand for this proposed special naphtha aircraft fuel, by stripping out the high boiling point fractions of their motor gasolines. A few companies, as has been reported,(2) are cutting back the 90% distillation point of their gasoline to around 300°F., for the purpose of achieving greater volatility in the higher boiling range. The material thus eliminated (about 10% of the total volume) comes within the boiling range of the proposed lighter-than-kerosine gas turbine aircraft fuel.

—V. B. G.

(1) "A Critical Survey of Commercial Turbine Fuels," H. E. Alquist and R. M. Schirmer, Phillips Petroleum Co., Research Division; SAE Golden Anniversary Aeronautic Meeting, New York, April 18-21, 1955.

(2) "What Next in Motor Fuels?" PETROLEUM PROCESSING, March 1955, pg. 343.

Concrete Deterioration—A New Corrosion Engineering Problem?

FOR many years the petroleum processing corrosion engineer's prime headache has been metals deterioration. Problems with other materials of construction have existed, of course—particularly wood for cooling towers, etc.

And now attention has been called to a new one—concrete. In a paper presented at the 20th Midyear meeting of the American Petroleum Institute's Division of Refining in St. Louis last month, John Zahodnick of Esso Standard Oil Co. discussed a study of severe corrosion of a concrete condenser-water sewer at the company's Bayway refinery.

Chief cause of corrosion was hydrogen sulfide in what was thought to be "clean water" in the refinery catalytic cracking unit sewer. Corrosion of concrete sewer pipe has been a common problem in sanitary and industrial waste systems for many years. However, it was entirely unexpected in this case. The sewer receives salt-water discharge from condensers and coolers, and water drawoff from distillate drums on the process unit.

The most significant characteristic of the corrosion process was apparently the fact that the attack was confined to the vapor space in the sewer pipe, with most severe concrete disintegration occurring just above the high-water level.

Prime requirement for this type of corrosion is that hydrogen sulfide be present in the sewer air. It is known that hydrogen sulfide is entrained with water vapor in various streams during process operations. These mixtures are condensed, and the water drawoff discharged into the sewer.

Hydrogen sulfide solutions are subsequently fixed on the pipe wall, forming weak acids. The reaction with the concrete, which has a natural pH value of 11 to 12, is very slow at this stage of the corrosion process. This was evidenced by the fact that the sewer

was visually inspected after three years of service, in 1951, and no corrosion was found at that time.

Evidently the corrosion processs was still in the preliminary stages, and the initial phase of surface disintegration had not been completed. Studies of corrosion rate curves indicated a very rapid climb in rates after the first three years. Depth of the disintegration jumped from about ⅛ in. to about 1¾ in. during that period.

What can be done about it? What is best method of repair? After considerable investigation of a number of approaches, Esso decided on the installation of a wire-mesh reinforced gunite lining of acid-resistant cement over the affected surfaces of the sewer.

A calcium-aluminate cement having high early strength and containing no free lime was selected. It is considerably more resistant to acid attack than is Portland cement and, therefore, retards the initial disintegration.

In addition, several bactericides were investigated in an effort to find one which, when incorporated in the cement, would inhibit or at least reduce bacterial activity without the usual adverse effects of admixtures in cement. Thus far, these studies have not turned up a satisfactory material.

This work has been important because the sulfur oxidizing bacteria are a big factor in the corrosion process. They produce high concentrations of sulfuric acid, and the pH value frequently drops to below 1. It is impossible to verify their prior existence in the early stages of the corrosion process, inasmuch as these bacteria cannot be identified in the analysis of the final corrosion products.

While it is still too early to know whether Esso's experience with concrete corrosion is an isolated case, one thing seems certain. Corrosion engineers in the future will have to continue facing up to new problems and perhaps quite a few with materials of construction other than metal. —W.C.U.

Cumene Derivative Has Potential As a Rubber Vulcanizer, Activator

WHEN Hercules Powder Co. put its new Gibbstown, N.J., petrochemical facilities on stream recently, the announced products were to be chiefly phenol and acetone. The plant is designed to produce annually 26,000,000 lb. of phenol, 16,000,000 lb. of acetone, and varying amounts of alpha-methylstyrene, acetophenone, and hydroperoxides with a combined total of around 4,000,000 lb.

The process used is Hercules' own—a cumene oxidation process—though an equivalent process was developed independently in England by Distillers Company Ltd. Benzene—about 50% from nearby refineries and 50% from nearby steel mills—is alkylated with propylene—extracted from refinery gas that Hercules pipes in from Socony-Vacuum Oil Co.'s Paulsboro, N.J., refinery adjacent the Gibbstown installation. Resultant cumene is oxidized to cumene hydroperoxide and this in turn undergoes cleavage to phenol and acetone. The detailed chemistry has been discussed previously in PETROLEUM PROCESSING.[1]

But Hercules hasn't stopped there. Though not revealing the exact size of the project, the company plans shortly to put in a full-scale unit tying in with cumene hydroperoxide to make another derivative—dicumyl peroxide. Trade-named "Di-Cup," the material has up to now been in pilot plant production at the Gibbstown plant.

The big application and market for dicumyl peroxide, as Hercules sees it, is in the rubber industry, as a substitute for sulfur in vulcanization as well as a substitute for the several compounds now being used as activators and accelerators. These latter are relatively expensive in comparison to sulfur, and therein lies dicumyl peroxide's advantage. If aimed as a sulfur substitute only, it would have no chance of selling against sulfur (6 to 9¢ per 100 lbs. of rubber). Activators and accelerators, on the other hand, run in range of $1.40 per 100 lbs. of rubber, and Hercules figures its Di-Cup can offer rubber makers an attractive advantage. —W.C.U.

(1) "Synthetic Phenol Manufacture," Peter W. Sherwood, PETROLEUM PROCESSING, Sept., 1953, pp. 1348-1354.

Will "No-Moving Part" Switches Hasten the Automatic Refinery?

ONE of the major objections to data handling equipment—or computers—for industrial use has been the lack of reliability of computer parts.

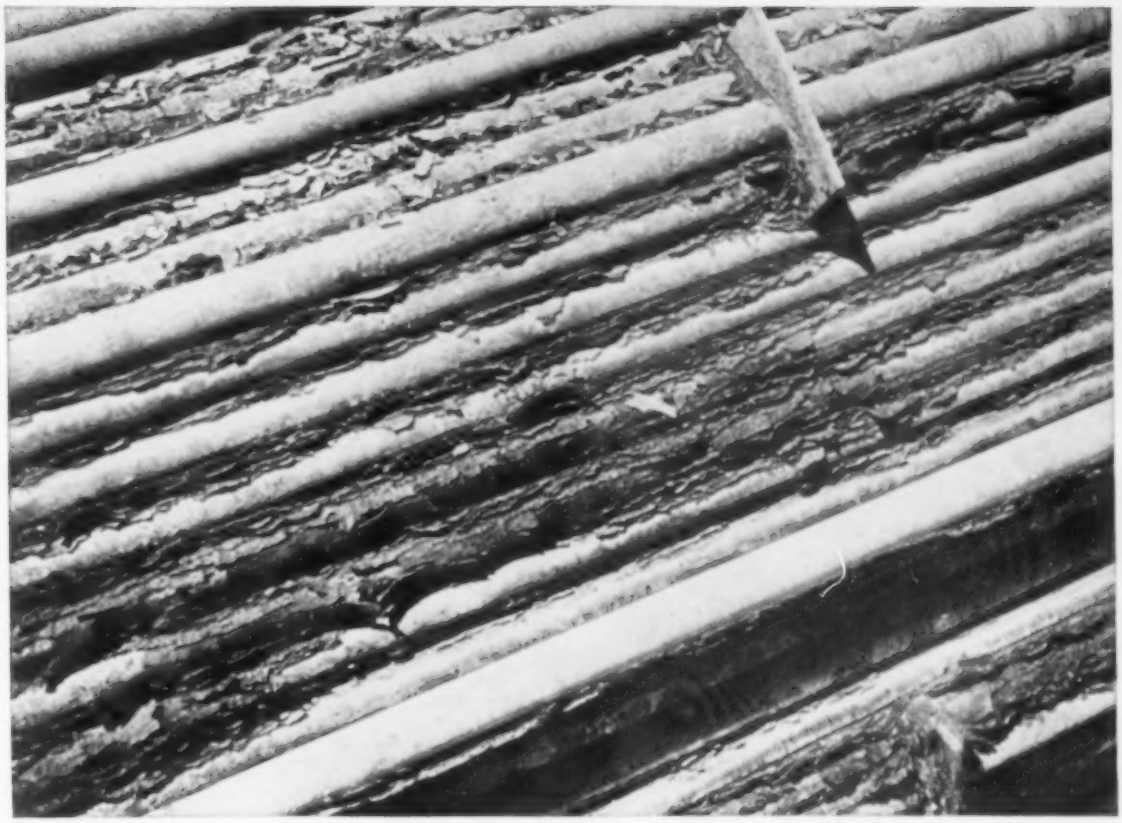
Electronic vacuum tubes are prone to inconsistencies and failures, mechanical relays are slow and can be trusted only for a few million operations—a short life for high speed digital computers—and germanium transistors require close environmental temperature control in order to function correctly.

Magnetic, no-moving-part flip-flops—recently announced by Westinghouse Electric Corp.—are potential solutions in the search for reliable, rugged, temperature-insensitive computer components.

Called the "Cypak," Westinghouse's magnetic flip-flop evolved from the area of solid state physics along with the magnetic amplifier and the transistor. Consisting of various arrangements of selenium semiconductor diodes and appropriate magnetic amplifier circuits, the Cypak can perform all of the basic computer functions of vacuum tube or mechanical relays such as "and," "or," "not" and "time delay."

While the Cypak units are not direct replacements for relays on a one-for-one basis, they are used as replacements for entire relay systems in data handling and sequence control equipment.

The day of complicated self-checking mechanisms and double computers—such as in the Univac, which consists of two computers constantly checking each other—and expensive air conditioning requirements for computers may be disappearing. If so, the day of computers and other data handling equipment necessary for the automatic refinery is closer than many of us realize. —R. L. D.



WHY PAY FOR THIS?

Why pay for fouling when Polyrad costs so little? Frequent down time for cleaning or replacing fouled and corroded equipment is no longer a normal operating expense for refineries. Not when Polyrad corrosion inhibitor can prevent damage with an average treatment of about 1 quart of Polyrad per 1,000 barrels of fluid.

Polyrad's powerful detergent action loosens organic and inorganic deposits and permits their removal in the fluid stream. This means you can prevent fouling by using Polyrad—and you can even clean up fouled equipment by starting Polyrad treatment. All around the refinery, Polyrad helps maintain throughput, increases heat transfer, reduces metal loss, and cuts down time for maintenance.

Polyrad is readily available from stocks maintained throughout the country. A Hercules technical representative will be glad to assist in evaluating Polyrad under your own operating conditions.

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The result is the first truly balanced catalyst offered for optimum performance in fluid catalytic cracking units.

Cyanamid was first to deliver a *high pore volume* catalyst.

For further information, ask your Cyanamid representative about AEROCAT Fluid Cracking Catalyst with high **PV.**

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REFINERY CHEMICALS DEPARTMENT
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Letters

Behind the Coker Story

TO THE EDITOR: Dear Boss: Re Mar. 15 assignment to get soup-to-nuts story on Carter's Fluid Coker, wonder why I keep working for you. Wasn't pleased with prospects of Montana in March. Trip started going bad right off. Carter has no decency; OK'd immediate visit; no suggestion of holding off for better weather. . . . Left Houston Monday, Mar. 21. Raining in Dallas; had to change planes; got more than slightly damp, plus shoe-full from unseen puddle. Snow flurries in Oklahoma City. Just cold in Billings. . . . Weather Tuesday not so cold; thought maybe troubles were over. Had two conferences at plant in morning. Went out after lunch to examine Coker. Climbed to top, 150 ft. Was admiring view; wind rose suddenly, then began to howl. Ground below blotted out by snow—falling "horizontally." Odor of polar bears very strong. Decided to examine coke burner; understood it operated at 1100 deg. Finally headed for stairs. Snow froze on glasses; couldn't see with them, couldn't see without them. Trip down very slow. Made frequent stops to examine hot areas of heater and reactor. For the record—temperature fell from 45 to 17 in 3 min.; wind hit 65. . . . More snow Wednesday morning. Temperature 1 above, plenty of wind. Ran into trouble over secrecy clearances; worked on another assignment. Trouble not cleared until late afternoon; meant staying over another day. . . . Snow stopped falling Thursday; temperature didn't. Hit 4 below at plant. Was invited to climb Coker again; declined—politely but firmly. . . . Headed south next morning. Temperature then 7 below. More ice in plane than on ground; heater not working so good. Breakfast: frozen juice, cold eggs, iced coffee. Stopped at Casper. Temperature then 17 below. Started to reboard plane, ground blizzard hit; called back to terminal; afraid we'd get lost. Crew strung rope to guide us. Back to plane; found door'd been left open. Had to wait while snow was shoveled out. Sun shining in Denver. Houston balmy at 40.

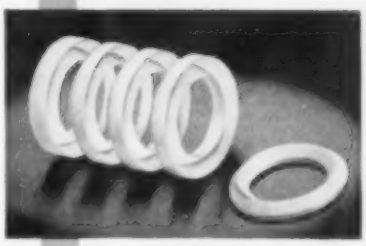
D. P. THORNTON, JR.
Southwestern Editor
PETROLEUM PROCESSING
Houston

• *All of which proves there's more to a story than writing it. For the article Dave got, see p. 840 this issue.*

MADE OF TEFLON
(E.I. DuPont Trademark)

Chemiseal Packing

- won't contaminate
- won't deteriorate
- won't "freeze" shaft action



V-TYPE PACKING

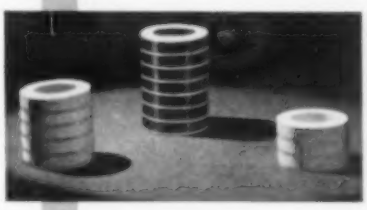
Chemiseal Type 810 TEFLON V-Packing for use in manual, air or motor operated valves. Construction and distinctive tapered V design offers chemically impervious service and greater flexibility and resiliency, providing necessary seal at low gland pressure and reduced torque on valve stem.

CUP AND CONE TYPE PACKING

Chemiseal Type 810-W TEFLON Packing for both hand and mechanically operated valves. Cones deform inwardly to effect a seal at the spindle, while cups expand outwardly against stuffing box wall, making possible a tight seal at low gland pressure.

WEDGE TYPE PACKING

Chemical Type 810-WX Packing offers the unusually low gland load required for valves made of Haveg, Karbate, ceramics, etc. Rings provide space for thermal expansion. Also adaptable for spring loading wherever exceptionally low friction load is required.



PUMP PACKING

Order Chemiseal Types 711-G, (graphite, impregnated) No. 711-M, (impregnated with mica) and No. 711-O (pure TEFLON). For general purpose or non-contaminating pump service throughout the processing industries.

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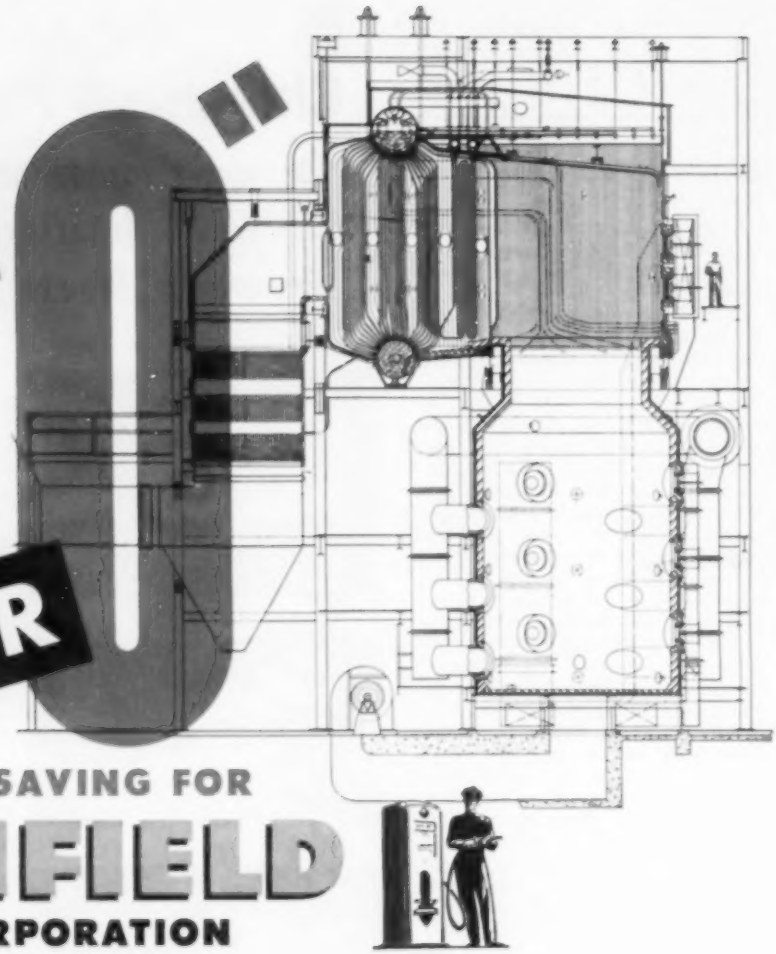
(To obtain more data on advertised products see page 916)

B&W "CO" BOILER



STARTS SAVING FOR

RICHFIELD

OIL CORPORATION

at Watson, California

Another big stride in waste heat reclamation was made at Richfield's Watson refinery when their new B&W CO (Carbon Monoxide) Boiler recently went on stream.

Utilizing the combustible carbon monoxide, as well as sensible heat, from the catalyst regenerator, the CO Boiler saves heat previously expelled to the atmosphere and wasted. From now on this heat will be burned and harnessed—a saving that is reckoned in thousands of dollars.

In addition, the boiler is an independent source of steam power for the entire fluid unit and its auxiliaries—available for steam even when the cracking unit is shut down.

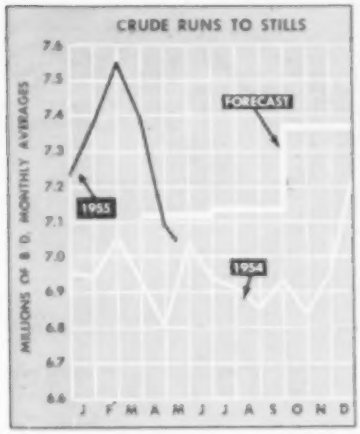
Its maximum continuous capacity is 340,000 lb of steam per hr at a pressure of 600 psi and a temperature of 750 F, burning either oil or gas as supplementary fuels.

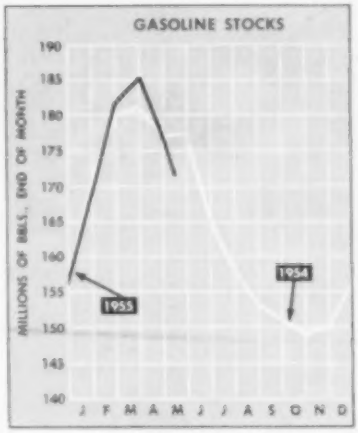
G-719

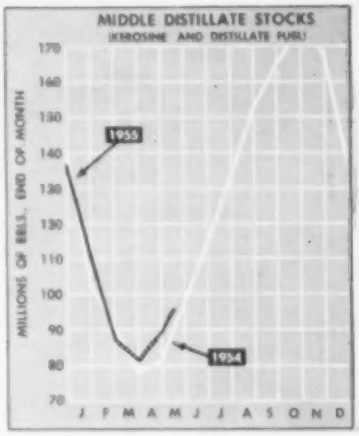
Besides representing a significant economic advance, the CO Boiler is an outstanding example of cooperation among companies with the common goal of lowering operating costs and raising an already outstanding efficiency still higher. C. F. Braun Company, the contractors, Richfield Oil Corp., and B&W—all are major contributors to what is rapidly proving to be a *saving* advance in the petroleum industry. Let us discuss with you and with your consulting engineers the working advantages of the B&W CO Boiler and give you additional details. The Babcock & Wilcox Company, Boiler Division, 161 East 42nd Street, New York 17, N. Y.

BABCOCK & WILCOX

BOILER DIVISION







1955 figures to May 13

Demand Estimates Up for Rest of '55

OUTLOOK: Summer distillate shipments will be pushed, to build up heating oil supplies in areas of consumption.

PLANT operations are being maintained at a level that holds total product inventories above their '54 levels.

Crude runs trended downward in early May. For the first two weeks, indicated runs were 7,046,000 b/d, about 1.9% above the same weeks in 1954. April runs were 4.2% higher than in 1954, and for the year to May 13th, they were approximately 4.4% over the same period a year ago.

Motor fuel demand is growing faster than the anticipated seasonal increase. April demand was 7.7% larger than April a year ago, and early May figures would tend to indicate the increase may be even larger in May.

U. S. gasoline stocks, May 13, dipped below last year's level by 4½ million bbls. Inventories in inland refining districts were 7.3% smaller. In the combined East Coast and Gulf Coast districts, they were 2.5% larger. In all areas, supplies are considered adequate for summer markets.

Demand for middle distillates (distillate fuels and kerosine) reflects the continuing building boom over the country. Domestic and export shipments, in the second and third quarter, are forecast at 1,317,000 b/d avg. This is almost 4.4% larger than actual demand during the same 6 months in 1954. For the coming heating oil season, Oct. 1, 1955-March 31, 1956, total middle distillate demand is forecast at 2,650,000 b/d avg. This would be 4.7% larger than actual demand in the same 1954-55 period.

One authority believes that with a normal winter, heating oil demand could be 9% larger than last winter.

Middle distillate stocks east of California, May 13, were over 10,000,000 bbls. (13.5%) larger than a year ago, reflecting the continuing high rate of refinery output.

Residual fuel oil demand continues to hold up well, over a year ago. East of California, refiners' stocks May 13 were down to 21,000,000 bbl.

MAY KEY STATISTICS

(Figures given in terms of millions of b/d, monthly averages, except stocks, which are in millions of bbls. at end of month)

	May 1955*	Apr. 1955	May 1954
CRUDE OIL			
U. S. Production	6.684	6.822	6.471
Imports	.660	.706	.708
U. S. Stocks	278.208	274.976	282.250
Runs to Stills	7.046	7.097	7.038
GASOLINE			
Refinery Output	3.458	3.411	3.377
Refinery Demand	3.961	3.820	3.463
Primary Stocks	171.134	176.399	177.606
MIDDLE DISTILLATES			
Refinery Output	1.748	1.849	1.674
Refinery Demand	1.253	1.562	1.169
Primary Stocks	95.661	89.233	97.473
RESIDUALS			
Refinery Output	1.072	1.143	1.148
Imports	.334	.362	.276
Total Supply	1.406	1.505	1.424
Refinery Demand	1.379	1.539	1.356
Primary Stocks	44.161	43.804	47.009

*Through May 13.

PRODUCT AND CRUDE PRICES

(Products—¢ gal., weighted average prices in principal refinery markets
Crudes—$/bbl., principal fields
Source—Platt's Oilgram Price Service

	May 1955*	Apr. 1955	May 1954
Gasoline	11.30	11.25	11.69
Distillate Fuel Oil	9.19	9.23	8.96
Kerosine	10.52	10.63	10.36
Residuals	4.30	4.26	3.86
Above 4 Products	8.84	8.82	8.87
Lube Oils	16.83	16.83	16.93
Crude	2.82	2.82	2.82

REFINERY YIELDS

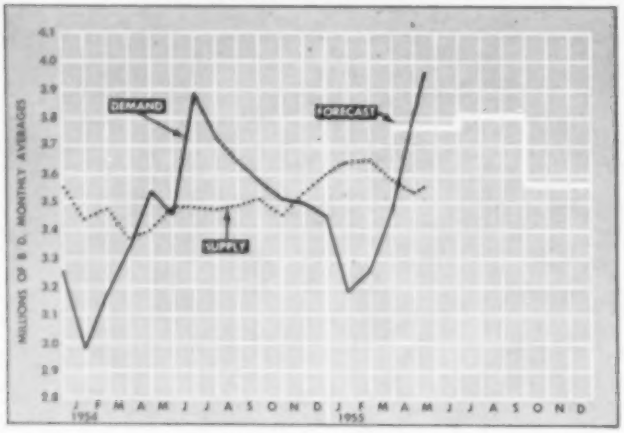
% on Crude Runs to Stills

	May 1955*	Apr. 1955	May 1954
Gasoline	44.4	43.7	44.7
Kerosine	4.2	4.5	4.4
Distillate	20.6	21.6	20.0
Residuals	15.2	16.1	16.7

*Through May 13.

SOURCE OF DATA (except prices): Mar., Apr. and May, API weekly reports; earlier months, Bureau of Mines

Motor Fuel Demand is Headed for New Peaks

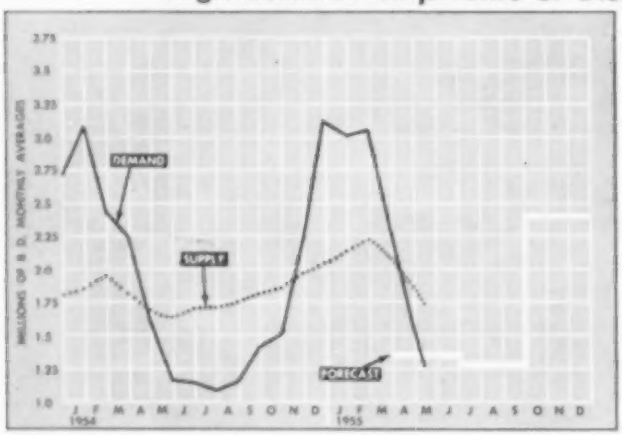


1955 figures to May 13

MOTOR FUELS

	From Crude	From Nat. Gas	Total
SUPPLY (Millions of b/d)			
Apr. '55	3.099	.430	3.529
Apr. '54	3.002	.402	3.404
Change	+ .097	+ .028	+ .125
% Change	+ 3.2	+ 7.0	+ 3.7
DEMAND (including Exports) (Millions of b/d)			
Apr. '55			3.820
Apr. '54			3.547
Change			+ .273
% Change			+ 7.7
TOTAL SUPPLY (Millions of bbls.)			
4 Mos. '55	380.494	51.847	432.341
4 Mos. '54	361.505	48.930	410.435
Change	+ 18.989	+ 2.917	+ 21.906
% Change	+ 5.2	+ 6.0	+ 5.3
TOTAL DEMAND (including Exports) (Millions of bbls.)			
4 Mos. '55			412.199
4 Mos. '54			391.307
Change			+ 20.892
% Change			+ 5.3

High Summer Shipments of Distillate Fuels Likely

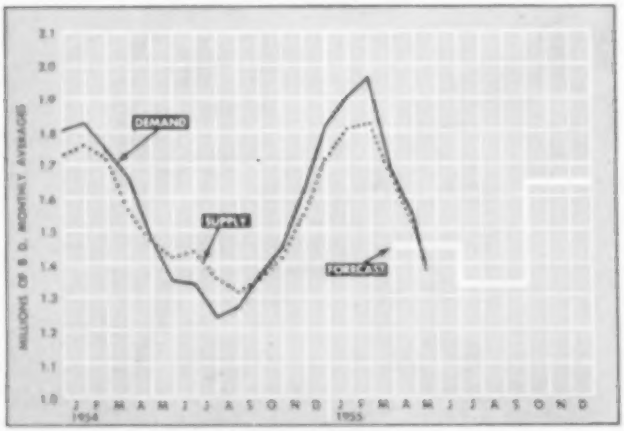


1955 figures to May 13

MIDDLE DISTILLATES

	Kerosine	Dist Fuel Oil	Total
PRODUCTION (Millions of b/d)			
Apr. '55	.316	1.533	1.849
Apr. '54	.322	1.374	1.696
Change	— .006	+ .159	+ .153
% Change	— 1.9	+ 11.6	+ 9.0
DEMAND (including Exports) (Millions of b/d)			
Apr. '55	.232	1.330	1.562
Apr. '54	.252	1.346	1.598
Change	— .020	— .016	— .036
% Change	— 7.9	— 1.2	— 2.3
TOTAL PRODUCTION (Millions of bbls.)			
4 Mos. '55	43.641	205.192	248.833
4 Mos. '54	44.236	175.152	219.388
Change	— .595	+ 30.040	+ 29.445
% Change	— 1.3	+ 17.2	+ 13.4
TOTAL DEMAND (including Exports) (Millions of bbls.)			
4 Mos. '55	50.853	244.331	295.184
4 Mos. '54	53.264	227.154	280.418
Change	— 2.411	+ 17.177	+ 14.766
% Change	— 4.5	+ 7.6	+ 5.3

Off Season Demand for "Resids" Is Larger



1955 figures to May 13

RESIDUAL FUELS

	Refinery Output	Imports	Total
SUPPLY (Millions of b/d)			
Apr. '55	1.143	.362	1.505
Apr. '54	1.140	.332	1.472
Change	+ .003	+ .030	+ .033
% Change	0	+ 9.0	+ 2.2
DEMAND (including Exports) (Millions of b/d)			
Apr. '55			1.539
Apr. '54			1.486
Change			+ .053
% Change			+ 3.6
TOTAL SUPPLY (Millions of bbls.)			
4 Mos. '55	143.991	59.758	203.749
4 Mos. '54	144.589	50.679	195.268
Change	— .598	+ 9.079	+ 8.481
% Change	— .04	+ 17.9	+ 4.3
TOTAL DEMAND (including Exports) (Millions of bbls.)			
4 Mos. '55			211.905
4 Mos. '54			202.117
Change			+ 9.788
% Change			+ 4.8

1955 figures to May 13

SOURCE OF DATA: Mar., Apr. and May, API weekly reports; earlier months, Bureau of Mines

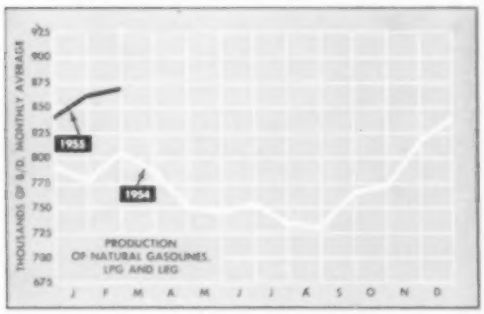
RUNS TO STILLS AND DISTRIBUTION OF PRIMARY STOCKS BY U. S. REFINERY DISTRICTS

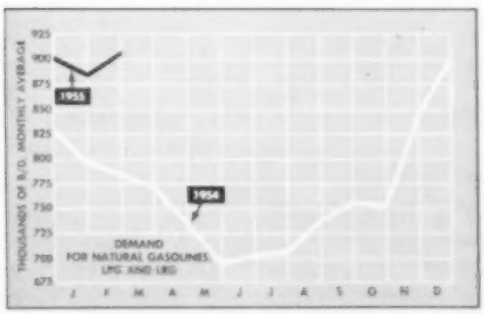
(Primary stocks include those at refineries, at large terminals and in pipelines; all data based on API reports)

District	RUNS TO STILLS (Millions of b/d average for week ending on date shown) May 13 1955	May 14 1954	Change	% Change	GASOLINE STOCKS (Millions of bbls., on date shown) May 13 1955	May 14 1954	Change	% Change	RESIDUAL STOCKS (Millions of bbls. on date shown) May 13 1955	May 14 1954	Change	% Change
East Coast	.878	1.006	— .128	—12.7	36.781	36.545	+ .236	+ 0.6	8.691	8.914	— .223	— 2.5
Gulf Coast	2.402	2.220	+ .182	+ 8.2	33.804	32.264	+1.540	+ 4.8	5.056	5.360	— .304	— 5.7
Total Coastal	3.280	3.226	+ .054	+ 1.7	70.585	68.809	+1.776	+ 2.5	13.747	14.274	— .527	— 3.7
Appalachian	.186	.193	— .007	— 3.6	7.615	7.079	+ .536	+ 7.6	.585	.919	— .334	—36.3
Ind.-Ill.-Ky.	1.317	1.317	0	0	32.253	39.138	—2.885	— 7.4	3.800	4.277	— .477	—11.2
Okla.-Kans.-Mo.	.655	.636	+ .019	+ 3.0	16.681	19.011	—2.330	—12.3	.887	1.277	— .390	—30.5
Other Inland	.556	.603	— .047	— 7.8	18.038	19.525	—1.487	— 7.6	2.085	2.523	— .438	—17.4
Total Inland	2.714	2.749	— .035	— 1.3	78.587	84.753	—6.166	— 7.3	7.357	8.996	—1.639	—18.2
Total East of Calif.	5.944	5.975	+ .019	+ 0.3	149.172	153.562	—4.390	— 2.9	21.104	23.270	—2.166	— 9.3
Calif.	1.067	1.045	+ .022	+ 2.1	21.962	22.188	— .226	— 1.0	23.057	21.726	+1.331	+ 6.1
Total U. S.	7.061	7.020	+ .041	+ 0.6	171.134	175.750	—4.616	— 2.6	44.161	44.996	— .835	— 1.9

District	DISTILLATE FUEL OIL STOCKS (Millions of bbls. on date shown) May 13 1955	May 14 1954	Change	% Change	KEROSINE STOCKS (Millions of bbls. on date shown) May 13 1955	May 14 1954	Change	% Change	TOTAL MIDDLE DISTILLATE STOCKS (Millions of bbls. on date shown) May 13 1955	May 14 1954	Change	% Change
East Coast	24.236	21.526	+2.710	+12.6	9.304	8.606	+ .698	+ 8.1	33.540	30.132	+3.408	+11.3
Gulf Coast	11.949	9.692	+2.257	+23.3	4.755	4.937	— .182	— 3.7	16.704	14.629	+2.075	+14.2
Total Coastal	36.185	31.218	+4.967	+16.0	14.059	13.543	+ .516	+ 3.8	50.244	44.761	+5.483	+12.2
Appalachian	2.430	1.882	+ .548	+29.1	.817	.800	+ .017	+ 2.1	3.247	2.682	+ .565	+21.1
Ind.-Ill.-Ky.	13.292	10.901	+2.391	+21.9	5.159	4.502	+ .657	+14.6	18.451	15.403	+3.048	+19.8
Okla.-Kans.-Mo.	8.154	7.470	+ .684	+ 9.2	1.162	1.259	— .097	— 7.7	9.316	8.729	+ .587	+ 6.7
Other Inland	4.498	4.147	+ .351	+ 8.5	1.459	1.135	+ .324	+28.5	5.957	5.282	+ .675	+12.8
Total Inland	28.374	24.400	+3.974	+16.3	8.597	7.696	+ .901	+11.7	36.971	32.096	+4.875	+15.2
Total East of Calif.	64.559	55.618	+8.941	+16.1	22.656	21.239	+1.417	+ 6.7	87.215	76.857	+10.358	+13.5
California	8.151	9.913	—1.762	—17.8	.295	.351	— .056	—16.0	8.446	10.264	—1.818	—17.7
Total U. S.	72.710	65.531	+7.179	+11.0	22.951	21.590	+1.361	+ 6.3	95.661	87.121	+8.540	+ 9.8

Natural Gas and Refinery Gas Liquids





SUPPLY AND DEMAND STATISTICS

(Bureau of Mines Data)

CURRENT PRODUCTION (1000 b/d monthly average)	Feb. 1955	Jan. 1955	Feb. 1954
At Natural Gasoline and Cycling Plants			
Liquefied Petroleum Gas	390	387	356
Natural Gasoline and Isopentane	270	267	257
Condensate	23	23	27
Finished Gasoline, Naphtha and other	67	69	65
Total Natural Gasoline and Cycling Plant Production	750	746	705
Liquefied Refinery Gases	117	114	102
Total Marketable Gas Liquids	867	860	807
Lease Condensate	114	110	102
Total Natural Gas Liquids	981	970	909
CURRENT DEMAND (1000 b/d monthly average)			
LPG and LRG	548	536	438
Natural Gasoline, Isopentane and other	360	347	339
Total Marketable Gas Liquids	908	883	777

CUMULATIVE PRODUCTION (1000 bbls.)	Feb. 1955	Feb. 1954
LPG and LRG	29,705	26,655
Natural Gasoline, Isopentane and other	21,237	20,088
Total Marketable Gas Liquids	50,942	46,743
CUMULATIVE DEMAND (1000 bbls.)		
LPG and LRG	31,966	26,433
Natural Gasoline, Isopentone and other	20,829	20,051
Total Marketable Gas Liquids	52,795	46,484

STOCKS (1000 bbls., end of month)	Feb. 1955	Jan. 1955	Feb. 1954
LPG and LRG	5,498	6,647	4,700
Natural Gasoline, Isopentane and other	5,064	5,052	4,924
Total Stocks	10,562	11,699	9,624

Fittings stay fastened in Corrosive Acid Spray

PROBLEM:

Selecting fastenings that would hold pipe fittings together in a unit that is constantly subjected to a hot sulphuric acid spray. Bolts were formerly falling apart in four months' time.

REMEDY:

Use of nuts and bolts made of wrought HASTELLOY alloy C.

RESULT:

Fastenings made of HASTELLOY alloy C are still holding many months after ordinary bolts had to be replaced.

HASTELLOY alloy C is the most universally corrosion-resistant alloy available today. In addition to aerated sulphuric acid, it has excellent resistance to such strong oxidizers as nitric acid, wet and dry chlorine, and acid solutions of salts. It is available in nearly all standard commercial forms.

For more information on HASTELLOY alloy C, get in touch with the nearest Haynes Stellite Company Office.

HAYNES TRADE-MARK ALLOYS

HAYNES STELLITE COMPANY

A Division of Union Carbide and Carbon Corporation

UCC

General Offices and Works, Kokomo, Indiana

Sales Offices

Chicago - Cleveland - Detroit - Houston - Los Angeles - New York - San Francisco - Tulsa

"Haynes" and "Hastelloy" are registered trade-marks of Union Carbide and Carbon Corporation

(To obtain more data on advertised products see page 916)

PETROLEUM CHEMICALS DIVISION
NEWS

June ★ One of a Series of Interest to the Petroleum Industry ★ 1955

New TEL Plant to be built by Du Pont in California

A new convenience will soon be realized by West Coast refiners when the planned Du Pont tetraethyl lead manufacturing plant near Antioch, California is completed.

The rapidly growing TEL requirements of the West Coast petroleum industry prompted the Du Pont Company's decision to build the plant in the California location. The site is approximately two miles east of Antioch on the San Joaquin River. It is readily accessible to both water and rail transportation.

Construction of the new plant is expected to get under way this summer. In addition to the TEL manufacturing facilities, a "Freon" refrigerants plant will also be constructed on the same site.

9 out of 10 WANT it

. . . and your dealers can profit by offering it

Oil check is the most important dealer service, say 90% of the motorists interviewed in a survey of consumer service station buying habits.

But does a check of the dip stick really sell oil? Actual service station observations show that almost half of the motorists who receive it buy oil as a result of the check. Yet customers are offered an oil check on only 36% of their service station stops.

This means that your dealers can increase their motor oil sales simply by offering to check the dip stick for *every* customer. To help you emphasize this profitable point to your dealers, we have prepared a new booklet (No. 4) in the "Looking through the windshield" series. The title is, "A look at the motor oil buyer."

Ask one of our representatives for sample copies and cost information on obtaining them in quantity.

You can profitably expand your diesel fuel market with Du Pont FOA-2

In addition to their growing demands for more diesel fuel, the railroads are endeavoring to reduce operating costs. In order to meet these demands and maintain your profit margin, you may be faced with the problem of producing diesel fuel at lower cost.

That's a tough problem, to be sure. But it *can* be solved. And here's how Du Pont Fuel Oil Additive No. 2 can help you solve it, *profitably*.

You simply use Du Pont FOA-2 to stabilize your cracked distillate stocks. Its double-action stabilizing and dispersant effect enables you to overcome the incompatibility between blends of cracked and straight-run stocks.

And this means added production flexibility for you . . . helps you keep your heating oil stocks in better balance to meet varying seasonal demands.

Proven results

Many leading railroads are now using No. 2 fuel oils containing Du Pont FOA-2. And they have reported excellent results.

They have proved through careful testing that they can efficiently operate diesel engines on cracked distillates stabilized with Du Pont FOA-2 without harmful effects.

Good filterability

Because of its excellent dispersant action, FOA-2 improves the filterability of diesel fuels. In this way it helps to eliminate most injector-sticking and filter-plugging problems.

Non-sparking

Being an *organic, non-metallic* additive, Du Pont FOA-2 does not contribute to the exhaust stack sparking problem.

OVER

ADVERTISEMENT—Prepared for the Petroleum Chemicals Division of E. I. du Pont de Nemours & Company (Inc.)

PETROLEUM CHEMICALS DIVISION
NEWS

CONTINUED *Diesel Fuel Additive*

Economical

Du Pont FOA-2 is extremely economical to use because it is effective in low concentrations. And you need no special equipment for adding it.

Test it yourself

Your fuel laboratory can easily test the effectiveness of FOA-2 in your own fuel oil stocks.

Free samples and complete technical information are readily available. Any Du Pont Petroleum Chemicals Division representative or regional office will be glad to supply them.

PHILADELPHIA DISTRICT MANAGER

LEWIS Z. CAREY is manager of the Du Pont Petroleum Chemicals Division's Philadelphia District, which serves the Delaware Valley area and the states of Maryland, Virginia, and North Carolina.

A graduate of the University of Delaware, he joined the Du Pont Company in 1941. He was a salesman in the Alcohol Division until 1950 when he was transferred to the Petroleum Chemicals Division as a sales-service representative.

Mr. Carey is vice-chairman of O.I.I.C. in New Castle County, Delaware and is active in both Delaware and Maryland O.I.I.C. activities.

During World War II, he served with the U. S. Navy.

HIGHLY SENSITIVE DEMONSTRATION ENGINE... to build dealer enthusiasm for your gasoline quality

Engine readings can be projected directly onto a screen for showings to large audiences. Or the unit can be set up on the back platform of a station wagon where the performance can be shown with the direct reading instruments.

Here is a brand new demonstration tool with an amazing talent for persuasion.

Gasoline quality may be one of the hardest things in the world to demonstrate clearly, even to dealers. But this new, single-cylinder engine setup can do it with superb showmanship. And if you want to turn a "doubting Thomas" into a satisfied customer, here's just the tool to do it with.

High compression engine

The unit is built around a single-cylinder engine with a 9.0 to 1 compression ratio. Other compression ratios are also available. With overhead valves and a hemispherical combustion chamber, it follows the latest design features of truly up-to-date automobile engines.

The engine is belted to an alternator and the power developed is dissipated in resistance grids.

Versatile

All types of combustion — normal, detonation and surface ignition — can be readily demonstrated with the unit. It can also be used to clearly demonstrate the wide variety of factors which influence knock — such as temperature, humidity, barometric pressure, spark timing, carburetor setting, etc.

Even wild ping and the various factors influencing surface ignition can be realistically shown.

Extremely sensitive, this engine will show up very slight differences in octane rating. And it is flexible enough to be adapted for tailor-made demonstrations to point up your own individual gasoline quality features.

Available soon

A number of these single-cylinder engine units are now being made and will soon be available to you on loan through any of our regional offices.

DU PONT

Better Things for Better Living
. . . through Chemistry

Petroleum Chemicals

E. I. DU PONT DE NEMOURS & COMPANY (INC.)
Petroleum Chemicals Division • Wilmington 98, Delaware

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A-9384

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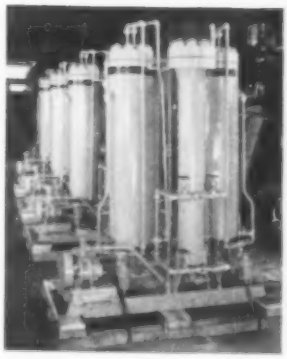
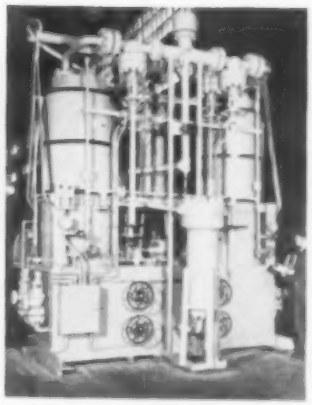
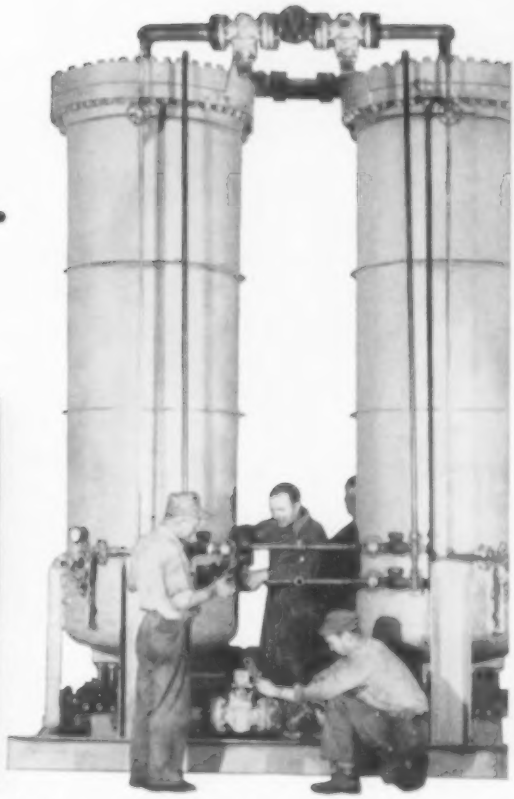
DRYing...

one of your problems... our full responsibility







Some Lectrodryers are built on a production-line basis. Most, however, are engineered and manufactured to suit each particular DRYing assignment.

Lectrodryer* engineers have a wealth of DRYing experience. For 23 years they've been helping processors get rid of unwanted moisture in air, gases and organic liquids. That experience is at your command, at no extra cost.

Why design, build and gamble on the effectiveness of an unproven drier? No need for you to have the bother, extra expense and delay which so often develop in a new product. Lectrodryers have demonstrated their DRYing ability. We have standard units which fit many requirements.

Let our engineers advise you on DRYing methods and equipment while the job is still on the drawing board. You may save at several points and, when the Lectrodryer gets on-stream, you know it's going to work.

For DRYing help and free literature that will assist in your planning, write Pittsburgh Lectrodryer Corporation, 332 32nd Street, Pittsburgh 30, Pennsylvania.

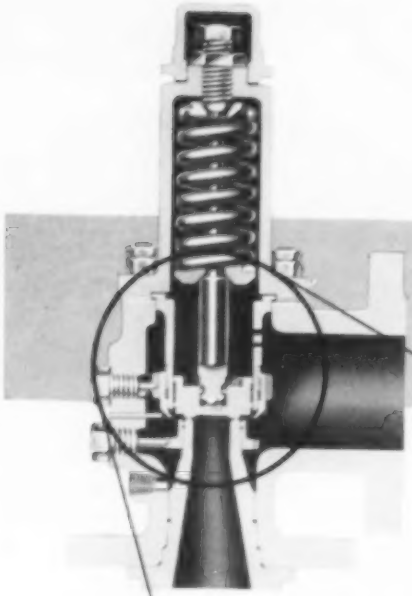
In England: Birlec, Limited, Tyburn Road, Erdington, Birmingham.
In France: Stein et Roubaix, 24 Rue Erlanger, Paris XVI.
In Belgium: S. A. Belge Stein et Roubaix, 320 Rue du Moulin, Bressoux-Liege.

LECTRODRYERS DRY WITH ACTIVATED ALUMINAS

LECTRODRYER

*REGISTERED TRADEMARK U.S. PAT. OFF.

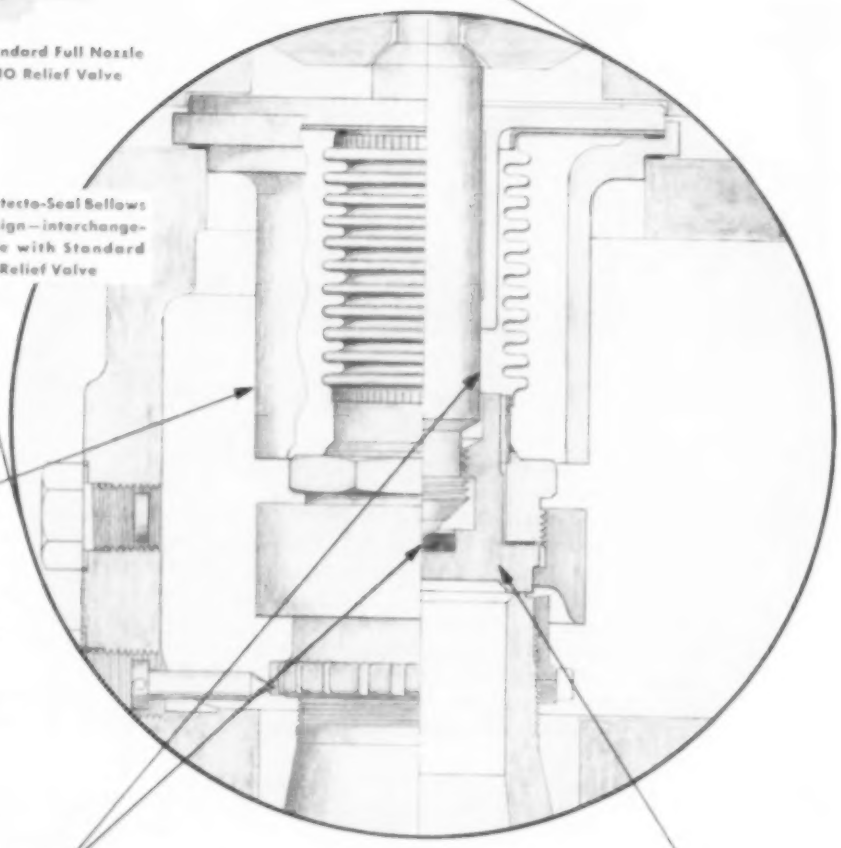
(To obtain more data on advertised products see page 916)



CROSBY Protecto

Standard Full Nozzle JO Relief Valve

Protecto-Seal Bellows Design—interchangeable with Standard JO Relief Valve



EXCLUSIVE

BELLOWS PROTECTOR
(Pat. Applied for)

1. *Isolates and protects Bellows from turbulence caused by flowing media—reducing tendency of Bellows to fatigue.*
2. *Acts as positive lift-stop thereby preventing over compression of the Bellows.*

EXCLUSIVE

1. All moving parts are guided and held in perfect alignment from a single member.
2. The floating disc is loaded at the lowest point possible in the diss to provide the best in alignment stability and seat tightness.

FLOATING DISC

1. Simplifies maintenance.
2. Ease of dis-assembly.
3. Permits remachining.
4. Anti-fouling.

(To obtain more data on advertised products see page 916)

Seal Bellows Relief Valve

The addition of the Crosby Protecto-Seal Relief Valve to the well known line of Crosby JO Relief Valves marks a forward step in the design and construction of valves primarily for use on services where protection against corrosion, fouling of working parts, and low back pressure surges is required. The design represents the results of field tests conducted under the severest operating conditions.

The design of the valve is featured by the EXCLUSIVE Bellows Protector which shields the Bellows from adverse turbulent effects from the flowing media, preventing premature failure of the Bellows due to fatigue. The two ply bellows is so designed that the effective area of the valve seating surface is essentially balanced to nullify the effect of variable and constant back pressure on the performance of the valve. Now, with the Protecto-Seal Valve and the Balanced Area Piston Type Valve, Crosby offers relief valves for the widest range of back pressure conditions.

The Protecto-Seal construction is available in eleven orifice sizes and is interchangeable with the present line of Full Nozzle JO Relief Valves. Pressure-temperature scopes and dimensions remain the same as listed in the present 300 Catalogue. Valves available with internal heating coils and flushing nozzles on request.

Send operating data to Wrentham for recommendations.

Proven Performance

Designed, tested, and proved in our own steam and water test laboratories over a wide range of pressures. Performance checked on:

GAS—A.S.M.E. Test Facility
VAPORS—Wide range of temperature and Pressure
LIQUIDS and FLASHING FLUIDS—Private Laboratories and Power Plants of a leading Public Utility

This Valve has been tested for performance and flow at pressures from 25 p.s.i. to 2500 p.s.i.

CROSBY STEAM GAGE & VALVE COMPANY

FACTORY: WRENTHAM, MASSACHUSETTS

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There's No Denying These Facts...

MORE THAN 1250 PETROCHEM-ISOFLOW FURNACE INSTALLATIONS THROUGHOUT THE WORLD

In Plants of Modern Design

PROVE THIS FURNACE

Most Efficient By Any Comparison

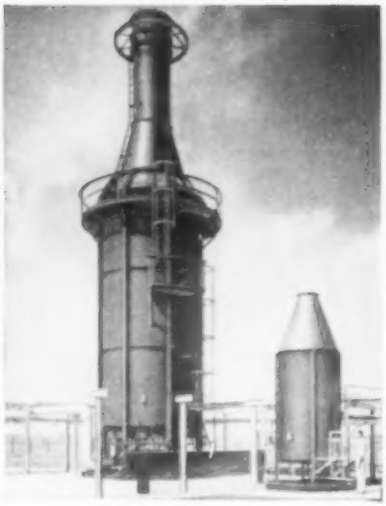
. . . for refiners using catalytic processes including: cracking, reforming, alkylation, polymerization, isomerization, desulfurization, hydrogenation and dehydrogenation.

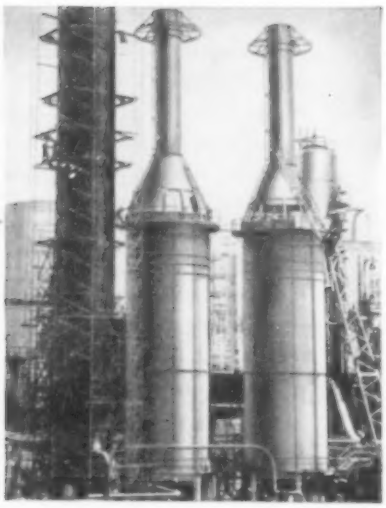
PETROCHEM-ISOFLOW FURNACES are Unlimited in Size . . . Capacity . . . Duty from 100,000 to 250,000,000 BTU PER HOUR

These are the 11 all-important factors which determine the value and efficiency of processing furnaces:

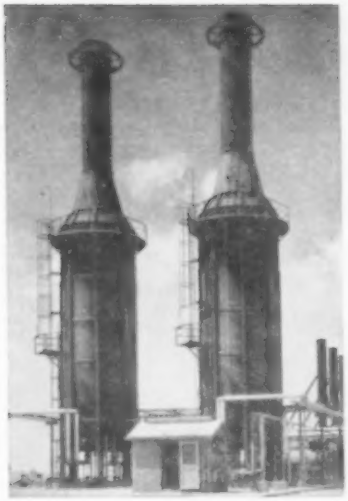
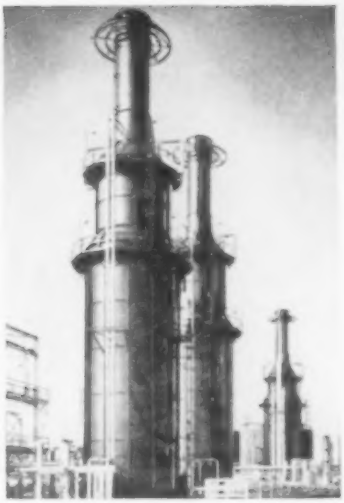
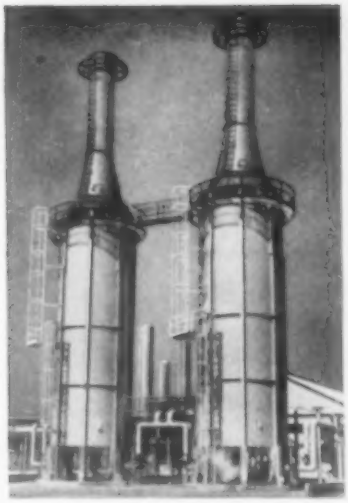
- UNIFORM HEAT DISTRIBUTION
- MAXIMUN FUEL EFFICIENCY
- PLENUM CHAMBERS FOR HAZARDOUS AREAS
- SIMPLICITY OF DESIGN AND CONSTRUCTION
- EXCESS DRAFT FOR HIGH OVERLOAD
- EXPLOSION RESISTANT
- MINIMUM GROUND SPACE
- SHORT LENGTH OF LIQUID TRAVEL
- ZERO AIR LEAKAGE
- LOW PRESSURE DROP
- LOW MAINTENANCE

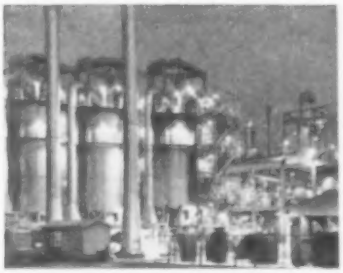
In every case where these 11 all-important design characteristics were employed to compare one type of furnace design with another, PETROCHEM-ISOFLOW FURNACES were proved most efficient by any comparison.





(To obtain more data on advertised products see page 916)



PETROCHEM-ISOFLOW FURNACES

UNLIMITED IN SIZE ... CAPACITY ... DUTY

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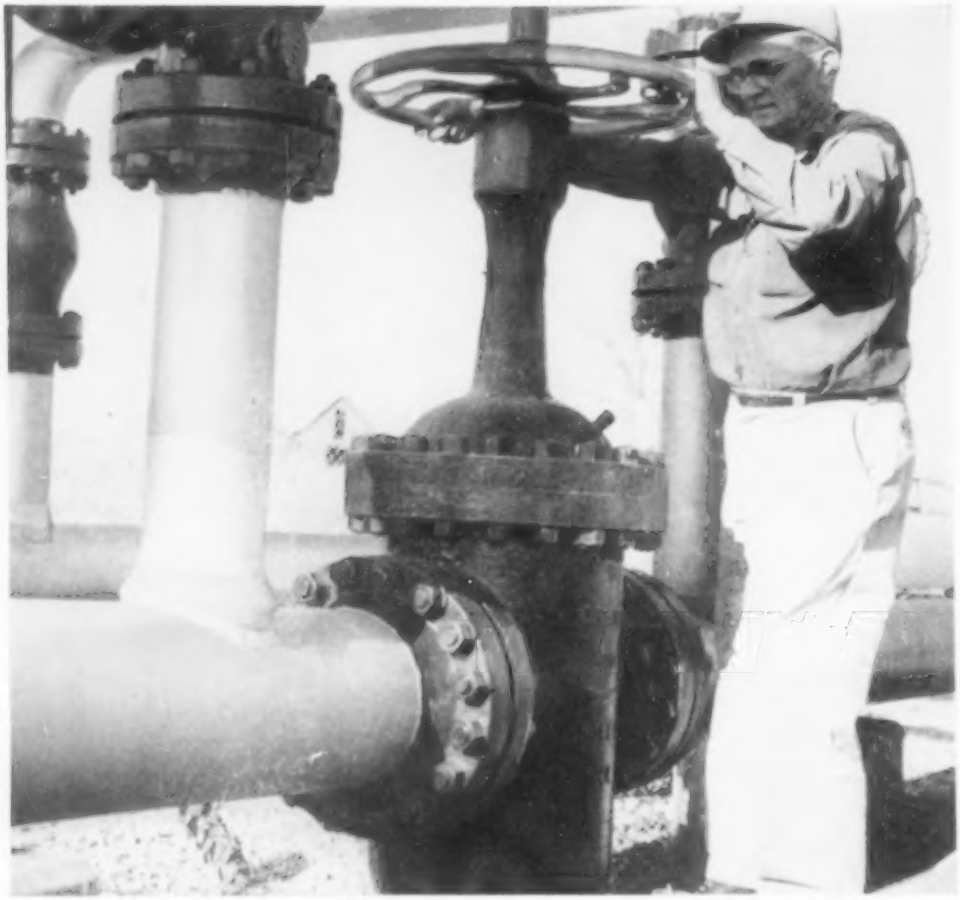
Foreign Representatives: SETEA—S. A., Buenos Aires, Argentine • Promotora Nacional De Industrias, S. A., Caracas, Venezuela • Firma Dr. C. Otto & Comp. G.M.B.H., Bochum, Germany • Birwelco Ltd., Birmingham, England • Societe Anonyme Heurtey, Paris, France • Societe Anonyme Belge, Liege, Belgium • Heurtey Italiana S.P.A., Milan, Italy •



Easy does it...year after year with this Crane pipe-line valve

THE CASE HISTORY—More than 3 years ago the Phillips Pipe Line Co. installed this Crane conduit valve in a junction manifold on its 10-inch crude line to Borger, from Yale Station, Oklahoma. How's it doing?

Operated every day or two until a few months ago, this Crane double-seating, grease-packed valve has always responded smoothly and easily to the handwheel—never sticking. Under former frequent usage as now with infrequent operation, it has never leaked at the bonnet joint or packing chamber—remains tight as new at the seats. This Crane valve—because its pressurized stuffing box eliminates leakage—is clean, unstained.

On gas and oil, these Crane valves are making big savings in operating costs. They're the leading value for pipe line service, and thrifty buyers know it. Crane Co., General Offices, Chicago 5, Illinois. Branches and Wholesalers in all industrial areas.

CLASS 600 STEEL PIPE-LINE GATE VALVES

Grease packing in body and bonnet assures thorough internal lubrication for easy operation. Parallel disc design gives tight closure; eliminates seat leakage. Spring plates in contact with disc faces keep foreign matter out of body. When open, conduit ports through disc give straight-line, unrestricted flow. Full-way or Venturi patterns, sizes 2 to 30 in. Literature sent by mail, or ask your Crane Representative.

CRANE CO.

VALVES • FITTINGS • PIPE
KITCHENS • PLUMBING • HEATING

CRANE'S FIRST CENTURY...1855-1955

GENERAL REFRACTORIES

GAS AND OIL . . . FROM BRICK When you say: "Fill 'er up", you're putting brick to work. Refractory brick. For once crude oil is pumped from the well, every process in making petroleum products depends on heat that only refractory lined furnaces can handle.

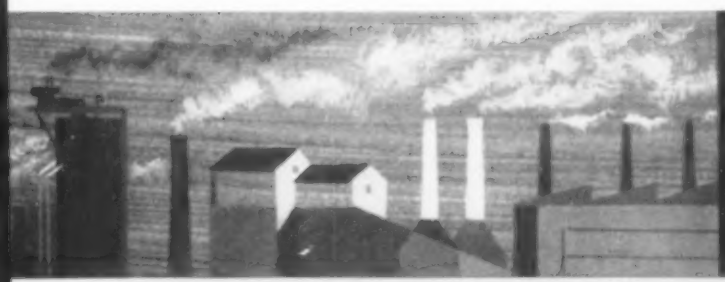
Practically everything you buy or use, everything that's made or moved, is dependent on refractories. The steel in your car, the glass in your windshield, the rubber in your tires, and the "blacktop" of your drive.

When you consider the enormous variety of industry, and the infinity of processes, you get some inkling of the tremendous technology and scientific reservoir that General Refractories draws on to produce refractories of highest efficiency and utility for specialized needs.

Company-owned sources half a world away pour in materials, all subject to the most exacting analyses and tests in the world's finest refractories laboratory, where new and finer products are constantly evolving.

With 66 mines and manufacturing plants, strategically located sales offices and warehouses, Grefco truly provides a complete refractories service.

GENERAL REFRACTORIES COMPANY
PHILADELPHIA 2



A COMPLETE REFRACTORY SERVICE

LITECAST-50—A hydraulic setting light weight castable having a density of approximately 50 lbs. per cu. ft. Available in regular mix and pneumatic gun mix.

HIGH-STRENGTH BRIK-CAST—A hydraulic setting clay base castable having exceptionally high strength. Available in regular, pneumatic gun mix and trowel mix.

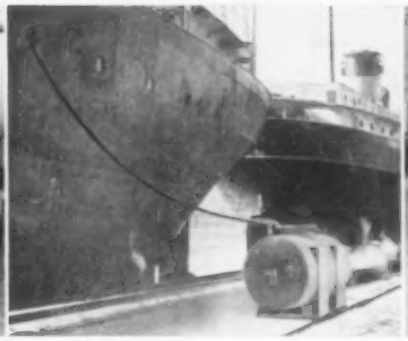
GREFCO CASTABLES are manufactured at 4 strategically located plants in Pennsylvania, Missouri, Texas, and California.

Here's *MASS-HANDLING* of bulk

What you see above is a Dempster-Dumpster serving one of its detachable containers. Multiply this simple pick up, haul and dump operation by scores of steel containers built to meet your requirements for handling waste or salvable materials, raw and finished products, fluids including acids, combustibles, dusty materials, etc. You have, then, mass-handling of bulk materials with one truck and one man!

Tilt Type Container is handling filter dirt at a plant in Illinois. Note container is equipped with casters and placed under chute, through which the filter dirt passes directly from presses. As each container is filled, it is replaced with an empty one.

Three heavy duty Drop Bottom Type Containers, shown below, are loaded with cast iron fittings from conveyor at plant in Birmingham. Dempster-Dumpster picks up each container when loaded and hauls the finished products to shipping department.



Tank Type Container is being filled with used oil from a ship. Time required to haul loaded container to reclaim station, drain and return for refilling—10 minutes. Time cycle of the former method using conventional barrels—60 minutes.

Here's another example of the many types of waste materials handled by this system. The Skip Type Container shown below is located under hydropulper at a paper plant. Picture was shot while container was being filled with rope waste sludge.

A loaded Apartment Type Container, equipped with roller bearing casters, is being rolled to outside of this plant building. Dempster-Dumpster will pick it up, haul to disposal area, dump the refuse and return empty container for refilling.

Waste materials are loaded into these Universal Containers at a food plant warehouse. Containers have lids in top, as well as a door in each end, which are opened to make deposits, then closed, sealing materials in container.

materials with one truck...one man!

A FEW OF THE HUNDREDS of containers available are shown above in actual service. They are built in capacities up to 21 cu. yds.—several times the capacity of the average dump truck body. One Dempster-Dumpster, operated by only one man, the driver, serves scores of big detachable containers, one after another—handling materials of every description. It's like having one truck with scores of bodies!

Records of performance in dozens of installations prove beyond question that savings are tremendous! The Dempster-Dumpster System cuts costs of equipment and operation. It is common knowledge that one Dempster-Dumpster will perform the work of several conventional trucks, reducing investment accordingly. This system eliminates standing idle time and re-handling of materials. Once placed in these containers, materials remain there until hauled to destination. Efficiency, sanitation and good plantkeeping are big advantages. Materials to be transferred or disposed of are constantly being placed in the containers as they accumulate. Containers for handling refuse are fire-proof, rat-proof and scavenger proof.

With no obligation on your part, our engineers will be glad to make a comprehensive fact-finding survey to determine the cost-cutting possibilities of this equipment in your plant. Write us for complete information today! Manufactured exclusively by Dempster Brothers, Inc.

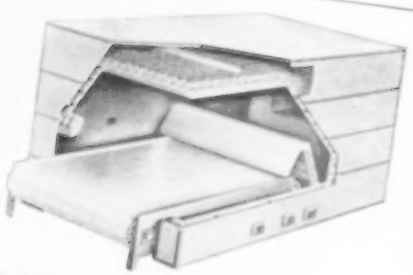
DEMPSTER BROTHERS 565 Dempster Building, Knoxville 17, Tennessee

MOIST FUEL CELLS

An important application of B-L unit-suspended walls and arches is found in furnaces where a fuel with a high moisture content is burned. Although designed primarily for use in cane sugar countries for bagasse burning, these furnaces have proven so successful in other fields such as the burning of bark and wet wood refuse.

BIGELOW-LIPTAK *Corporation*

UNIT-SUSPENDED WALLS AND ARCHES



DRYER FURNACES

A tough assignment for a furnace is to stand up under the every-day beating of heat in drying applications. B-L's streamlined thin wall dryer furnace does it—cuts maintenance to boot. It furnishes heat for drying coal, sugar, salt, lumber, chemicals.

BIGELOW-LIPTAK *Corporation*

LOWEST MAINTENANCE

When you specify a B-L furnace enclosure you can be sure of long life and lowest possible maintenance. Intelligent engineering and top-quality materials provide the stand-up stamina that makes enclosures "tougher than blazes." Each unit is individually designed for the job. Write today for complete information.

Castable Linings

B-L's castable lining for oil refining furnaces provides a smooth monolithic wall capable of resisting abrasion and standing up under high heat demands. The construction is adaptable to catalytic regenerators, catalytic reactors, cyclones, stacks and other refinery equipment.

BIGELOW-LIPTAK *Corporation*

UNIT-SUSPENDED WALLS AND ARCHES

BIGELOW-LIPTAK *Corporation*

AND BIGELOW-LIPTAK EXPORT CORPORATION

2550 WEST GRAND BOULEVARD, DETROIT 8, MICHIGAN

UNIT-SUSPENDED WALLS AND ARCHES

In Canada: BIGELOW-LIPTAK OF CANADA, LTD., *Toronto, Ontario*

ATLANTA • BOSTON • BUFFALO • CHICAGO • CLEVELAND • DENVER • HOUSTON • LOS ANGELES • MINNEAPOLIS • NEW YORK PHILADELPHIA • PITTSBURGH • PORTLAND, ORE • ST. LOUIS • ST PAUL • SALT LAKE CITY • SAN FRANCISCO • SEATTLE • TULSA • VANCOUVER, B.C.

(To obtain more data on advertised products see page 916)

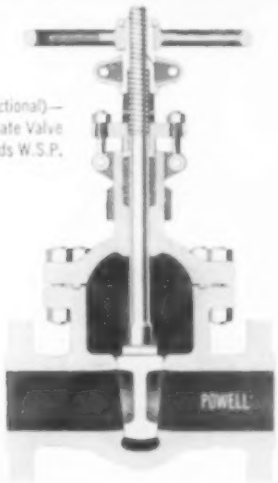
FIG. 3003 FE—Steel Gate Valve For 300 Pounds W.S.P.

Performance-- Value...

FIG. 1561—150-Pound Steel Swing Check Valve.

. . . POWELL VALVES . . . THE COMPLETE QUALITY LINE . . . POWELL VALVES . . .

FIG. 6003 SS (Sectional)—Alloy Steel Gate Valve For 600 Pounds W.S.P.



Powell Valves

FIG. 1559—150-Pound Steel Lubricated Plug Valve.

You can depend on outstanding *performance* from every valve made by The Wm. Powell Company, for Powell Valves have a proven record of long life and dependable service.

And Powell Valves give you better *value!* They're precision made and incorporate many quality features—features that can save you money and give you lasting flow control.

Consult your Powell Valve distributor. If none is near you, we'll be pleased to tell you about our *COMPLETE quality line*, and help solve any flow control problem you may have.

The Wm. Powell Company, Cincinnati 22, Ohio . . . . . 109th year

WHEN YOU'RE UP IN THE AIR

OVER PROCESS EQUIPMENT...

THE ANSWER IS

KELLOGG-ENGINEERED

FABRICATION

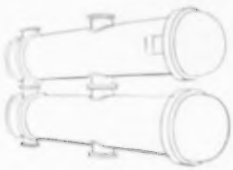
We emphasize "engineered" because M. W. Kellogg means much more than just putting together heat exchangers, pressure vessels, piping and other process equipment. Backed by a complete metallurgical and welding research staff, Kellogg process equipment is designed and fabricated by men who are recognized authorities in the field of heat transfer, stress analysis, welding techniques, non-destructive testing—and who constantly keep up with what is happening for tomorrow.

You can save many precious man-hours for your own engineers with Kellogg-engineered process equipment. You can assign the design problem to Kellogg or have Kellogg review your own design engineering to assure an optimum design. Your engineers will find it stimulating and profitable to work with the Kellogg staff.

Kellogg process equipment means top performance at minimum investment and prompt deliveries. It is engineered for the job by engineers who *know* their jobs. If recently you have not had firsthand experience with the Kellogg Fabricated Products Division, we would welcome the opportunity to describe our expanded services and manufacturing facilities.

FABRICATED PRODUCTS DIVISION
THE M. W. KELLOGG COMPANY, 225 BROADWAY, NEW YORK 7, N. Y.
In Canada: The Canadian Kellogg Company, Limited, Toronto
In Europe: Kellogg International Corporation, London
SUBSIDIARIES OF PULLMAN INCORPORATED

GET IT RIGHT FROM M W KELLOGG



HEAT TRANSFER EQUIPMENT

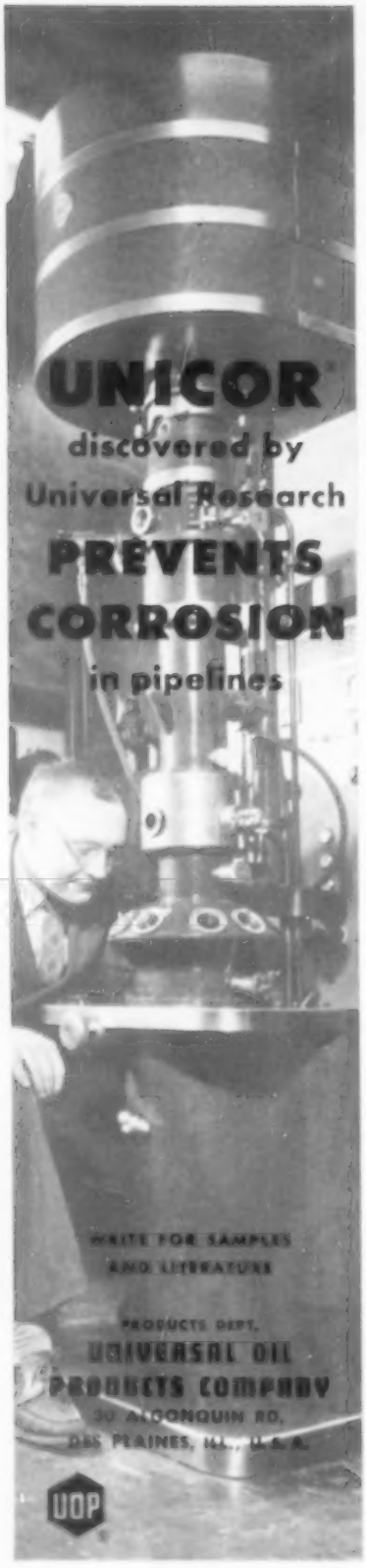
TANKS AND REACTORS

KNOCKDOWN VESSELS

PROCESS PIPING

PRESSURE VESSELS

(To obtain more data on advertised products see page 916)



The Control of Corrosion, Fouling and Product Contamination in Pipelines, Storage Tanks & Tankers

The corrosion problems of the petroleum industry may be roughly classified into three parts, namely, (a) production or oil well problems, (b) refinery problems dealing with process equipment and (c) corrosion problems of the transportation division, such as those occurring in pipelines, storage tanks and tankers. In this discussion we are considering only the corrosion problems associated with the transportation and storage of highly refined distillate products. For example, with gasoline or jet fuel the corrosion problem is usually one of rusting caused by moisture. The resultant peptized rust stabilizes an emulsion of minute particles of water fog causing a contaminated gasoline or an unsafe jet fuel.

Methods of proved merit for preventing this situation include (1) product dehydration, (2) the use of nitrite, chromate or other water-soluble rust preventives, (3) the addition of oil-soluble, film-forming, organic inhibitors, (4) the use of special alloy or plastic pipe and (5) interior plastic coatings or liners.

A substantial and significant amount of evidence from laboratory and field sources during the past year has confirmed the need for using oil-soluble corrosion inhibitors for the maximum protection of pipelines and tankers. The unique position of Unicor in this class of inhibitors is apparent to pipeline operators for the following important reasons:

Unicor prevents rusting in product pipelines at concentrations well below 10 ppm. Since it is distributed uniformly over the entire internal surface by the product itself, this protection is virtually 100% effective.

Unicor is slime-detergent and anti-fouling. No rusting can occur since Unicor's surface-activity causes a water-repellent film to be formed on the pipe's interior. This film sheds corrosive droplets.

Unicor is economical by virtue of (a) its low cost which is about 0.05c/bbl. of pipeline product, (b) the minute concentrations required and (c) its persistence in products from the refinery through the pipeline to the consumer, making re-inhibition unnecessary.

Water in a products pipeline is destructive. Its addition is unnecessary with Unicor. Unicor will also prevent rusting caused by unavoidably entrained or dissolved moisture.

Mechanical cleaning maintenance is materially reduced. The use of scrapers and the replacement of filters is reduced by over 50 per cent.

The beneficial effect of Unicor will extend to pipelines, storage tanks, tankers and ultimately even to consumer equipment when it is added within the refinery.

Addition at only one point is required since Unicor is distributed by the oil phase and is unaffected by water.

Unicor will not interfere with the action of other useful additives such as tetraethyl lead, antioxidants and dyes, and it has been especially prepared to avoid deleterious effects on gasoline stability.

Unicor has been formulated to meet the exacting water tolerance requirements of ASTM D910-53T as determined by ASTM D1094-53 in regard to entrainment of moisture and rust in hydrocarbon fuels. Unicor treated fuel rejects moisture.

Unicor is a non-irritating, non-toxic inhibitor; safe to handle and easy to apply.

Unicor is sold exclusively by Universal Oil Products Company. The technical services of petroleum specialists are available without charge to assist in the design, installation, and operation of a Unicor system of protection. For samples and information, write to Products Department, Universal Oil Products Company, 30 Algonquin Road, Des Plaines, Illinois.

(To obtain more data on advertised products see page 916)

Carey insulation materials have weathered 25 years of continuous service on the fractionating tower and vapor lines of these atmospheric and vacuum stills at Gulf Oil Corporation's Port Arthur, Texas, plant.

25th Anniversary of tough Texas service at Gulf

...Carey Magnesia Insulations defy vibration, humidity, heat!

Continuous outdoor service for 25 years! That's the record set by Carey magnesia insulation at Gulf Oil Corporation's big refinery, Port Arthur, Texas. And here, service conditions are *really* rugged. Besides the unmerciful vibration, expansion and contraction present in every refinery operation, you have blazing sun, high winds, heavy rains and corrosive salt air!

Carey's experience in development and manufacture of insulation products since 1873 is *one* big reason why Carey insulations are so outstanding. And it's the reason, too, why we believe we can help you solve your heat insulation problems, unusual though they may be.

The Carey line includes insulation for sub-zero to 2500° F service. Major products are Super-Light 85% Magnesia and Tempchek in precision-sized blocks and nesting "O. D." pipe coverings; blankets; pipe wrapping and jackets; cements. All excel in ease of application; are economical to use. Ask your Carey Industrial Sales Engineer for helpful advice.

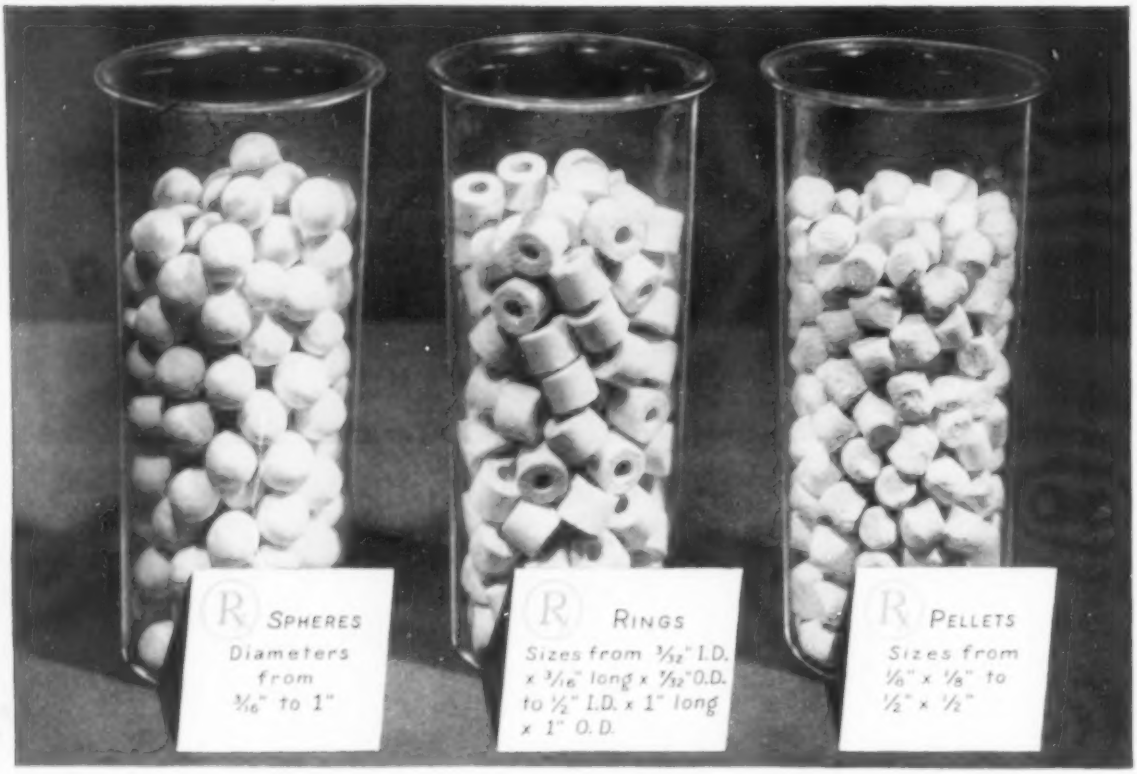
Write for your free copy of catalog giving complete technical and application data. Address Dept. PP-6.

Quality Products for Industry, Farm and Home Since 1873

Carey Industrial Insulation

THE PHILIP CAREY MFG. COMPANY
Lockland, Cincinnati 15, Ohio
In Canada: The Philip Carey Co., Ltd., Montreal 3, P. Q.

Carey-approved contract units in major trading areas. Consult your nearest Carey District Office or your telephone directory.


R SPHERES
Diameters from 3/16" to 1"
R RINGS
Sizes from 3/32" I.D. x 3/16" long x 3/32" O.D. to 1/2" I.D. x 1" long x 1" O.D.
R PELLETS
Sizes from 1/8" x 1/8" to 1/2" x 1/2"

What are your catalyst carrier applications?

Norton engineered and prescribed carriers offer you important processing advantages

What do you need? An inert, high alumina carrier for fixed bed oxidation reactions — such as those involved in the manufacture of phthalic anhydride, maleic anhydride and ethylene oxide?

An inert, low density carrier for use as a space filler or tower packing?

Norton ALUNDUM* fused alpha alumina carriers are proving highly successful in such processes. Containing 77% to 89% alumina, they are outstanding for chemical stability and resistance to abrasion and erosion — and their low density is a valuable quality in packing and filling applications.

ALUNDUM carriers are commercially available in the form of spheres, rings and pellets. Also available in experimental quantities are carriers made of MAGNORITE*, CRYSTOLON*, Fused Stabilized Zirconia and Kyanite materials.

ALUNDUM Spherical Carriers

provide uniform beds in catalytic converters, reducing channeling and pressure drop to a minimum. Medium porosity spheres (40%-44%) have a network of open pores on the outside surface only. These are specifically recommended for applications where the carrier is coated with a catalyst. High porosity spheres (45%-49%) have an internal as well as external network of pores, and are suitable for applications where the carrier is impregnated with a catalyst.

Other Norton Refractories

for chemical processing include porous mediums, laboratory ware, ALUNDUM, MAGNORITE, CRYSTOLON, and Fused Stabilized Zirconia shapes. All are *engineered and prescribed* to give you the best possible Rx — the most effective combination of physical characteristics plus thermal, chemical and electrical properties. For details call in your Norton Refractories Engineer, or write, mentioning your specific requirements to NORTON COMPANY, 265 New Bond St., Worcester 6, Mass. *Canadian Representative:* A. P. Green Fire Brick Co., Ltd., Toronto, Canada.

NORTON
REFRACTORIES
Engineered... Rx... Prescribed

Making better products... to make your products better

*Trade-Marks Reg. U. S. Pat. Off. and Foreign Countries

(To obtain more data on advertised products see page 916)

SHELL REPORTS

A PICTURE ROUNDUP OF SOME ACTIVITIES THAT MADE NEWS OUTSIDE THE PETROLEUM WORLD

A CAPITAL CONTRACT. To power its new turbo-prop Viscounts, Capital Airlines has selected Shell Oil Company as its supplier of fuel. Throughout flight history, as aeronautical engineers have built new engines and new planes, Shell research has developed the fuels to fly them. Shell Oil Company, leading supplier of aviation fuels to the United States commercial airlines, is helping turbo-prop travel become available for everybody.

ROCK AGER. What Mother Nature takes 10 million years to accomplish, Shell's atom smasher completes in one week. Behind thick walls, particles of rock are bombarded with radiation and thus aged by the first 2-million-volt Van De Graff accelerator in the petroleum industry. In this way, members of Shell's Exploration and Production Research Division are learning more about the age of rock and the origin of oil. Shell's advanced techniques in oil research are a strong investment in today to provide for tomorrow.

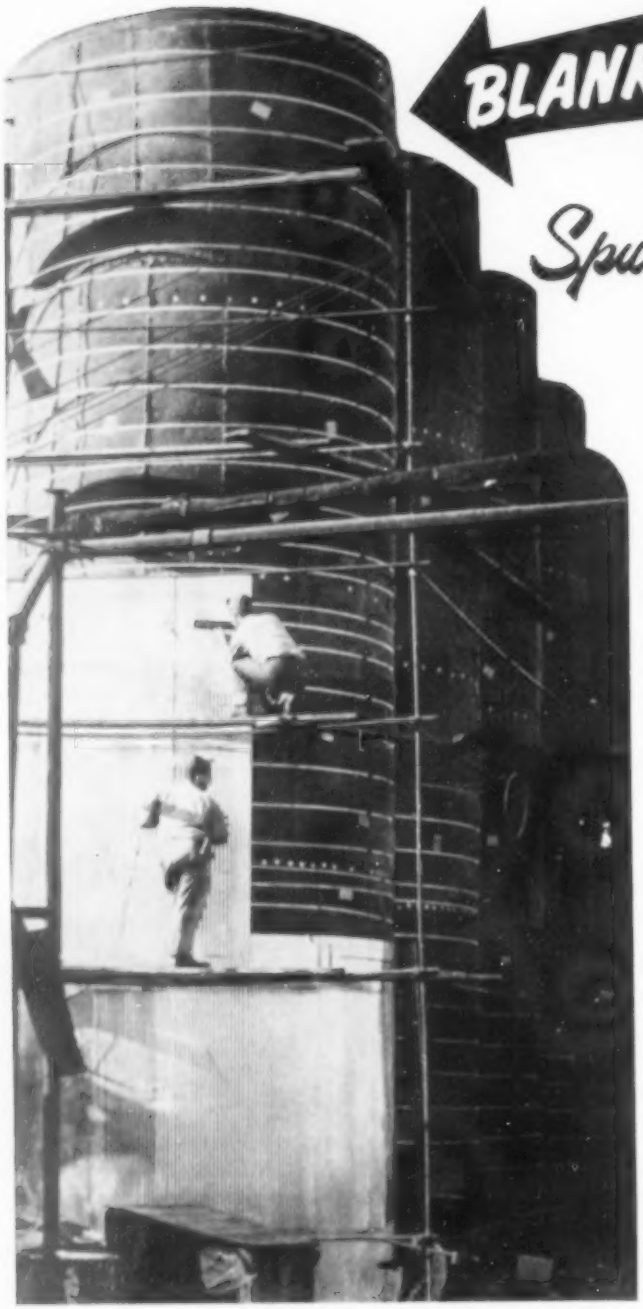
HITTING THE ROAD. It's the new method developed by Shell to measure the load-carrying capacity of asphalt. Electronic impulses simulate the jarring effects of traffic, and record the effects of continuous vehicular movement. Without damaging the highways, engineers get a long-range picture of how much a road can take. Shell's research is a step towards a better understanding of road requirements — and to more efficient, longer-lasting highways in the future.

SHELL

(To obtain more data on advertised products see page 916)

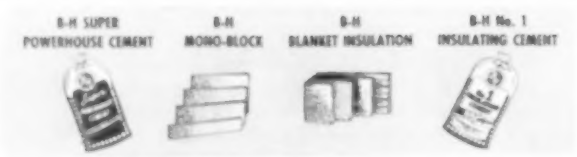
NOW... a better insulating

BLANKET made with BALDWIN-HILL Spun MINERAL WOOL



Baldwin-Hill insulating Blankets now have a lower density but greater strength due to the longer, finer mineral wool fibers produced by the new B-H spinning process. With the lighter weight, B-H Blankets are applied with amazing ease and speed.

Storage Tanks insulated with 1½" thick B-H Blankets having 1" wire mesh on one side; expanded metal lath on other side



BALDWIN-HILL COMPANY

1606 Breunig Ave., Trenton 2, N. J.

Kalamazoo, Mich. • Huntington, Ind. • Temple, Texas

B&W TUBING UNIFORMITY – MULTIPLIED 1194 TIMES

If you had this many tubes to roll in, there would be no delay if you used B&W tubes.

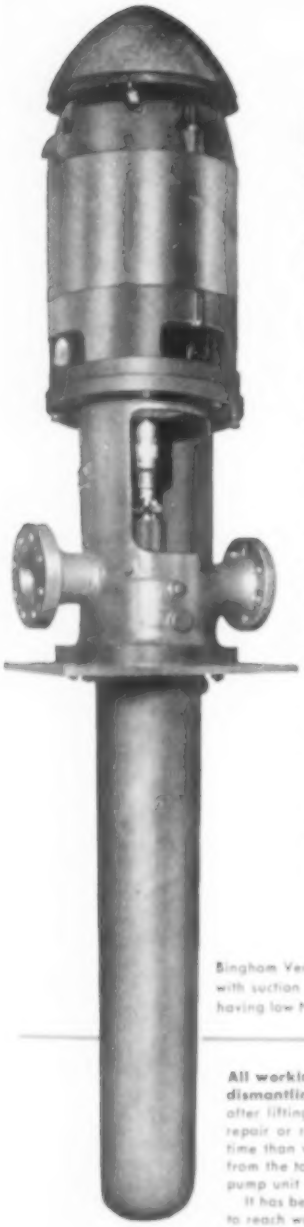
For heat exchangers, for condensers, in fact for every pressure tubing application, you can rely on B&W tubing for uniform wall thickness, uniform ductility, tight joints, and low installation cost.

Always specify B&W pressure tubing. It meets all dimensional and mechanical requirements, and is available, in all commercial sizes, in a wide range of carbon, alloy and stainless grades. *Write for Technical Bulletin 329PP.*

THE BABCOCK & WILCOX COMPANY
TUBULAR PRODUCTS DIVISION
Beaver Falls, Pa. and Milwaukee, Wis.: Seamless Tubing, Welded Stainless Steel tubing
Alliance, Ohio: Welded Carbon Steel Tubing
Milwaukee, Wis.: Seamless Welding Fittings

TA-5019(P)

NEW! Bingham ALL WORKING PARTS

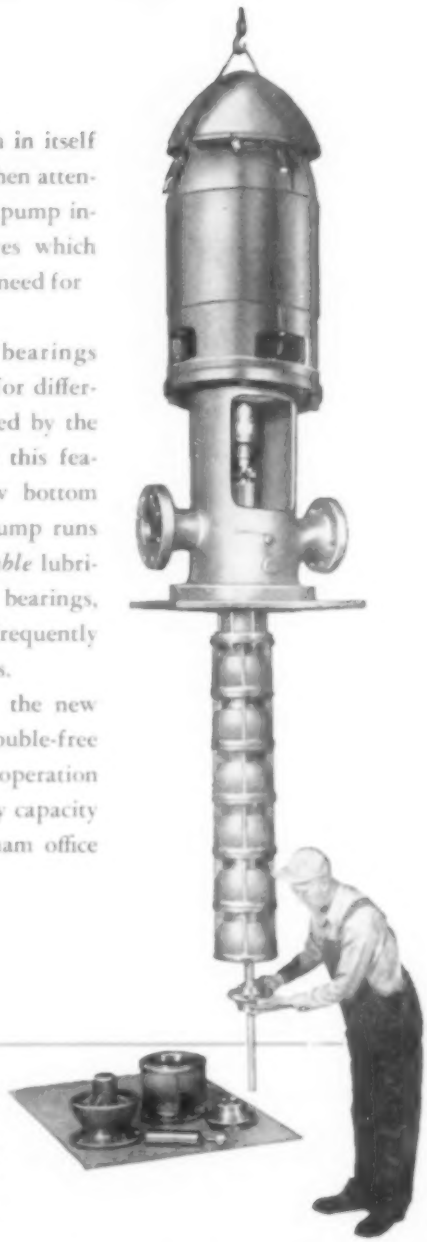


Besides bottom dismantling, which in itself greatly reduces maintenance time when attention is required, this new Bingham pump incorporates advanced design features which minimize maintenance, reducing the need for periodic inspection.

For example, all intermediate bearings (supplied of appropriate material for different pumpages) are forced-lubricated by the pumpage. Diagram at right shows this feature and, in addition, shows how bottom bearing is lubricated even if the pump runs dry for short periods. This *dependable* lubrication greatly prolongs the life of bearings, which in conventional pumps are frequently the cause of maintenance shutdowns.

Wherever it has been installed, the new Bingham VCP Pump has given trouble-free service—plus unsurpassed smooth operation with no vibration. Available for any capacity or head. Write your nearest Bingham office for additional information.

Bingham Vertical VCP assembled with suction well for installations having low NPSH conditions.



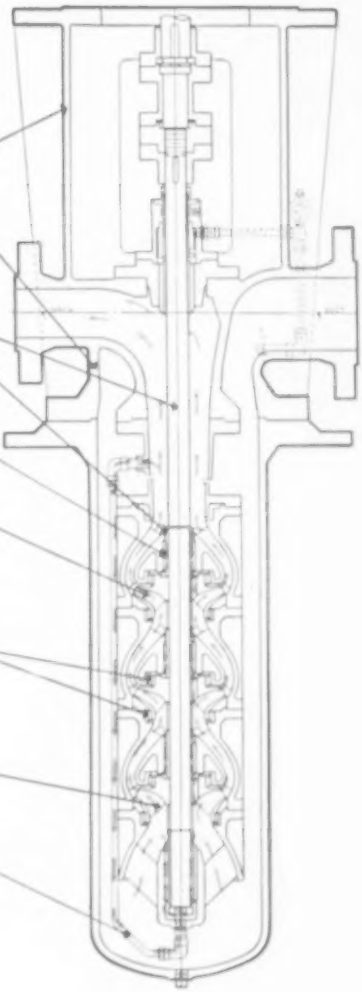
All working parts of pump easily accessible with bottom dismantling. One man can service the Bingham VCP Pump after lifting pump from well. By dismantling from the bottom, repair or replacement of any part can be made in much less time than with conventional pumps (where dismantling begins from the top, necessitating removal of driver and head before pump unit is accessible).

It has been estimated by various operators that time required to reach working parts has been reduced as much as 50%.

VCP VERTICAL PUMP FOR LOW NPSH
ACCESSIBLE WITH BOTTOM DISMANTLING

ONLY *Bingham* OFFERS ALL THESE BENEFITS:

1. Heavy-duty steel suction and discharge head rigidly built to eliminate vibration caused by drivers.
2. Shaft is maximum diameter throughout.
3. Shafts are equipped with renewable 11-13 chrome, hardened, ground and polished sleeves at each bearing.
4. Bearings are of the appropriate material for the different pumpages.
5. Maximum head per stage and maximum efficiency for a given capacity range.
6. Front and back wearing rings on enclosed type impellers permit a one-stage pressure drop over each bearing for lubrication purposes.
7. Wear rings reduce thrust of rotating element, permitting use of standard motors.
8. Maximum eye area of bottom impeller for lowest possible NPSH.
9. Bottom bearing lubricated by pumpage taken from the discharge column, which, together with connecting pipe, acts as a reservoir for bearing lubrication in event pump operates "dry" for short periods.



Bingham PUMPS
SINCE 1921

BINGHAM PUMP COMPANY
General Offices: 2800 N.W. Front Avenue, Portland 10, Oregon
Factories: Portland, Ore. • Vancouver, B.C., Canada

SALES AND SERVICE OFFICES

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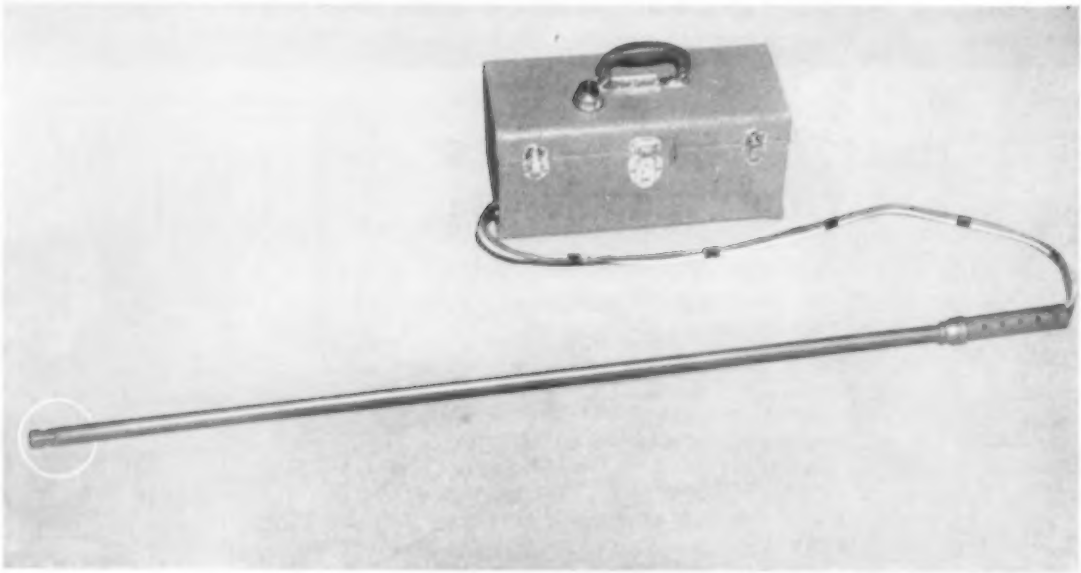
DENVER, COLO.	SEATTLE, WASH.
HOUSTON, TEXAS	ST. LOUIS, MO.
KANSAS CITY, MO.	ST. PAUL, MINN.
NEW ORLEANS, LA.	TULSA, OKLA.
NEW YORK CITY, N.Y.	TORONTO, ONT., CAN.
PHILADELPHIA, PA.	VANCOUVER, B.C., CAN.

JZ JOHN ZINK

PORTABLE IGNITER!



Now light any gas fired Furnace . . .

Now light any gas fired furnace . . . with ease and safety to men and equipment. JOHN ZINK IGNITER is completely self contained. One man operation . . . weighs less than 30 pounds. Igniter tube any length up to 72". Uses cheap, readily available dry batteries. Priced much lower than you expect.

THIS IS WORTH YOUR ATTENTION

John Zink Company
4401 So. Peoria Avenue
Tulsa, Oklahoma

Gentlemen: Please send descriptive information and price of the John Zink PORTABLE IGNITER.

Name _____ Title _____

Company _____

Address _____

City _____ State _____

"We'll send you a good mechanical pencil, (Free) just for taking your time to mail us this request."

For complete information and price, fill in the coupon and mail it to

JOHN ZINK COMPANY

4401 S. PEORIA TULSA, OKLA.

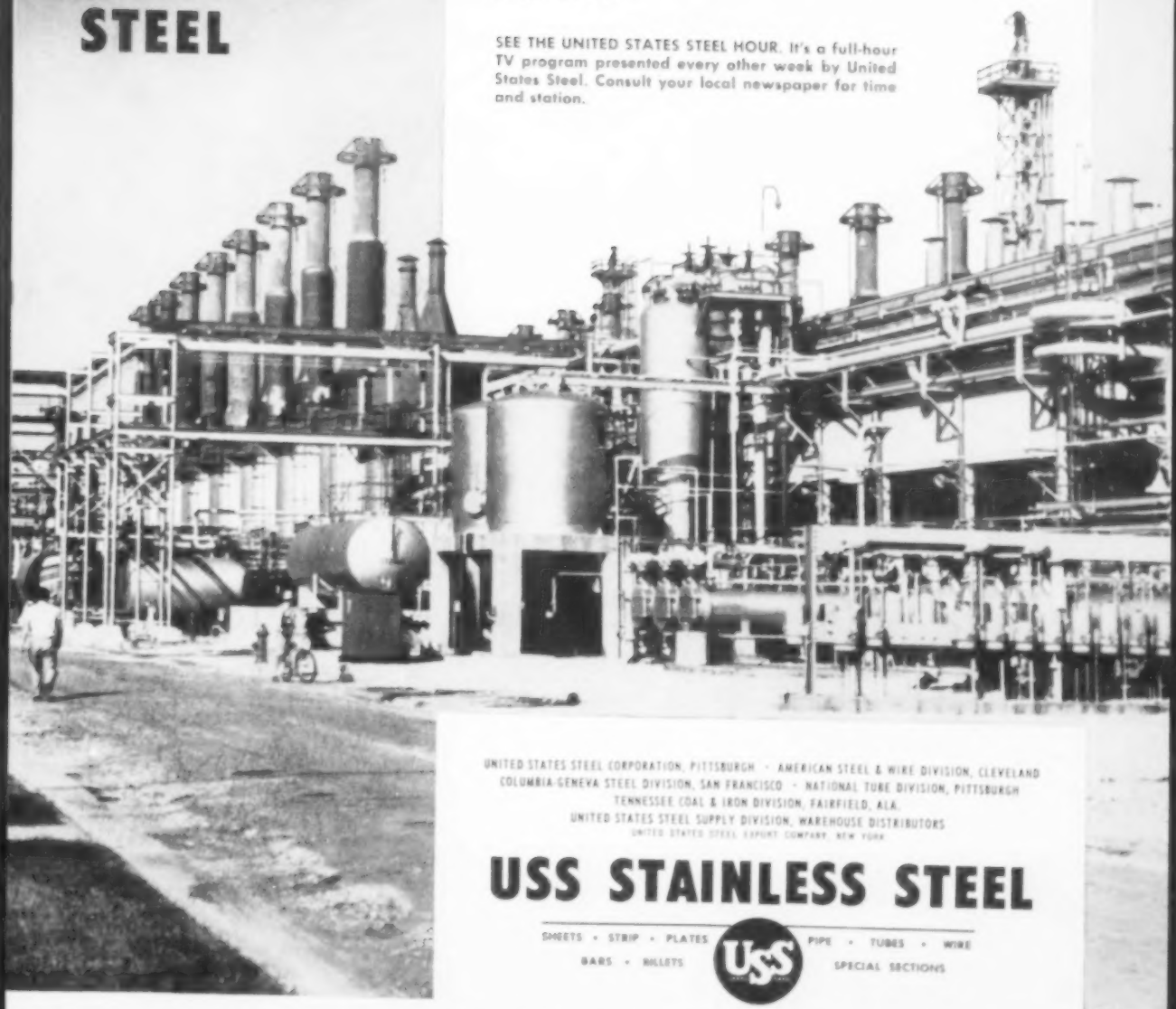
for styrene production

STAINLESS STEEL

To withstand the conditions that cause corrosion and oxidation in a big styrene plant, Stainless Steel was selected as the material for the tubes in these super heaters.

It's only one of many places where the vastly expanding petrochemical industry has met a problem of heat and corrosion with Stainless Steel. In USS Stainless Steel you have the widest variety of compositions for greatly varying applications. The ways in which USS Stainless Steel has met problems similar to those you may be encountering is described in our booklet "Performance of Stainless Steel in Petroleum Refinery Service." For your copy, write to United States Steel Corporation, 525 William Penn Place, Pittsburgh 30, Pa.

SEE THE UNITED STATES STEEL HOUR. It's a full-hour TV program presented every other week by United States Steel. Consult your local newspaper for time and station.



UNITED STATES STEEL CORPORATION, PITTSBURGH · AMERICAN STEEL & WIRE DIVISION, CLEVELAND
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO · NATIONAL TUBE DIVISION, PITTSBURGH
TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA.
UNITED STATES STEEL SUPPLY DIVISION, WAREHOUSE DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

USS STAINLESS STEEL

SHEETS · STRIP · PLATES · PIPE · TUBES · WIRE
BARS · BILLETS · SPECIAL SECTIONS

USS

UNITED STATES STEEL

Rockwell-Nordstrom
LUBRICANT

Rockwell-Nordstrom Valves Prove Lubrication Is The Cheapest Maintenance!

LUBRICATION ELIMINATES METAL-TO-METAL FRICTION

—the major source of valve wear. As in your automobile engine, lubrication assures longer life and better performance. Pressurized lubricant also forms a remarkably leakproof seal between the plug and the valve body. This lubricant seal has proven far more effective than the uncertain metal-to-metal seal in ordinary valves where a tiny scratch means leakage . . . and eventually, expensive reseating.

Costly valve down time is practically eliminated with Rockwell-Nordstrom valves because lubrication stops trouble before it starts. The lubricant also hydraulically jacks the plug to eliminate stuck or jammed valves, assures *instant*, quarter turn operation.

LUBRICATION IS FAST...EASY

Rockwell-Nordstrom valves can be lubricated either with a pressure gun directly through the standard Rockwell fitting or by unscrewing the fitting and inserting lubricant "sticks." Lubrication never requires valve down time because any Rockwell-Nordstrom valve can be lubricated under service pressure.

Like any lubricated mechanism, frequency of use and operating conditions are the determining factors in the lubrication schedule. In any case, the time it takes to lubricate a Rockwell-Nordstrom valve is an investment in trouble-free, long-life valve service.

LUBRICATION PENNIES SAVE MAINTENANCE DOLLARS

A few cents worth of lubricant buys three things: 1. *new seats* (renewing the lubricant is like reseating an ordinary valve) . . . 2. *smooth, dependable operation* and . . . 3. *savings* in terms of lower repair, replacement and down time expenses. It is not the cost of the lubricant that is important, but the *savings* through longer, more dependable life of the working parts and better performance.

GENUINE ROCKWELL-NORDSTROM LUBRICANTS are specially compounded to not only reduce friction, but also to create a positive, leakproof seal. They are the result of 40 years of production "know-how" and field testing by the pioneer lubricated plug valve manufacturer. Their sole purpose is to insure that Rockwell-Nordstrom valves give you the best valve service you've ever had. That's why it's good business to use *only* genuine Rockwell-Nordstrom lubricants in Rockwell-Nordstrom valves.

40 YEARS OF PERFORMANCE PROVE that Rockwell-Nordstrom valves are the most economical valves you can buy for *any* service. Over the years, the sale of repair parts has been less than one-half of one per cent of Rockwell-Nordstrom valve total valve sales . . . *for every two dollars users spend on Rockwell-Nordstrom valves, they spend less than one penny for repairs.*

Whatever your needs, there is a Rockwell-Nordstrom valve that will do the job with more trouble-free dependability and at lower cost per year than any other valve you've ever used. And the first cost of Rockwell-Nordstrom valves is no more (and often less) than the cost of ordinary valves! For more information, write: Rockwell Manufacturing Company, Pittsburgh 8, Pa.

Canadian Valve Licensee: Peacock Brothers Limited

ROCKWELL-Nordstrom VALVES

LUBRICANT SEALED FOR POSITIVE SHUT-OFF

Have you tried ALCOA

It resists:

sulfur-bearing gases
carbon dioxide
cooling waters
refinery atmospheres
seacoast environments

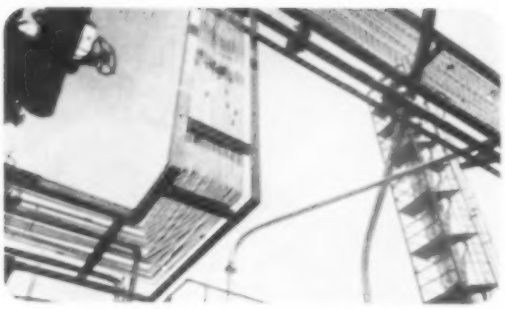
It costs less than other corrosion-resistant metals

It has successfully handled all of these commodities:

Acetaldehyde
Acetanilide
Acetic Acid
Acetic Anhydride
Acetone
Acrylic Acid, Glacial
Acrylonitrile
Aerosol Propellants
Alcohols—methyl, ethyl, propyl and higher
Ammonia Gas and Solutions
Ammonium Nitrate and Ammoniated Ammonium Nitrate
Amyl Mercaptan
Benzaldehyde and Benzyl Alcohol
Benzene
Butyric Acid and Anhydride
Carbon Dioxide Gas and Solutions
Creosote
Diethanolamine
Essential Oils, Edible Oils, Vegetable Oils
Explosives
Fats, all types
Fatty Acids—oleic, palmitic, stearic, etc.
Formaldehyde
Gases as Butane, Propane, etc.
Glycerine
Glycols—ethylene, propylene
Glycolamine Solutions
Hexane
Hydrogen Peroxide
Latex and Ammoniated Latex Solutions
Methyl Ethyl Ketone
Mineral Spirits
Monoethanolamine
Napthalene
Naphtha, Solvent
Naval Stores—rosins, turpentine
Nitric Acid (above 82%)
Nitroparaffins, crude and refined
Orthodichlorobenzene
Oxygen, Nitrogen and Liquid Air
Paraffin
Phenol
Resins, synthetic
Sulfur
Tar and Tar Products
Thinners, Paint
Toluene
Trichlorobenzene
Waxes—petroleum
Water—distilled, fresh, brackish, sea

It is light in weight . . . easily worked . . . strong

It resists corrosion . . . has excellent low-temperature properties



ALCOA ALUMINUM INSTRUMENT TUBING is enjoying wide use in the petroleum industry. ALCOA Utilitube® comes in lengths up to 1,000 feet and more . . . costs 40 per cent less than other corrosion-resistant metal tube.

ALCOA STANDARD STORAGE TANKS give excellent service. Aluminum tank roofs have been in service more than 22 years in locations where steel failed in less than five years. Aluminum tank cars have been in use more than 25 years.

(To obtain more data on advertised products see page 916)

ALUMINUM in your refinery?

ALCOA ALUMINUM PIPE is light, easy to handle. It does not cause sludging of lubricating oil or gum formation in gasoline. Welding, threaded or other mechanical fittings can be used. Ideal for handrails, scaffolds, gates.

ALCOA ALUMINUM SHEET is used to weatherproof towers, heat exchangers and pipelines. It's the favorite lightweight metal for roofing and siding that withstands corrosive atmospheres with minimum maintenance.

ALCOA ALUMINUM HEAT EXCHANGER TUBES have been used for more than 20 years, handling sour gasoline stocks. Ideal for catalytic overhead condensers, compressor intercoolers and aftercoolers.

Investigate ALCOA Aluminum today. Get all the facts. They're in ALCOA'S new, free book, "Process Industries Applications of Alcoa Aluminum." Use the coupon for your free copy.

ALCOA ALUMINUM

ALUMINUM COMPANY OF AMERICA

Aluminum Company of America
1000-F Alcoa Building, Mellon Square
Pittsburgh 19, Pennsylvania

Please send me your new, FREE book, "Process Industries Applications of Alcoa Aluminum."

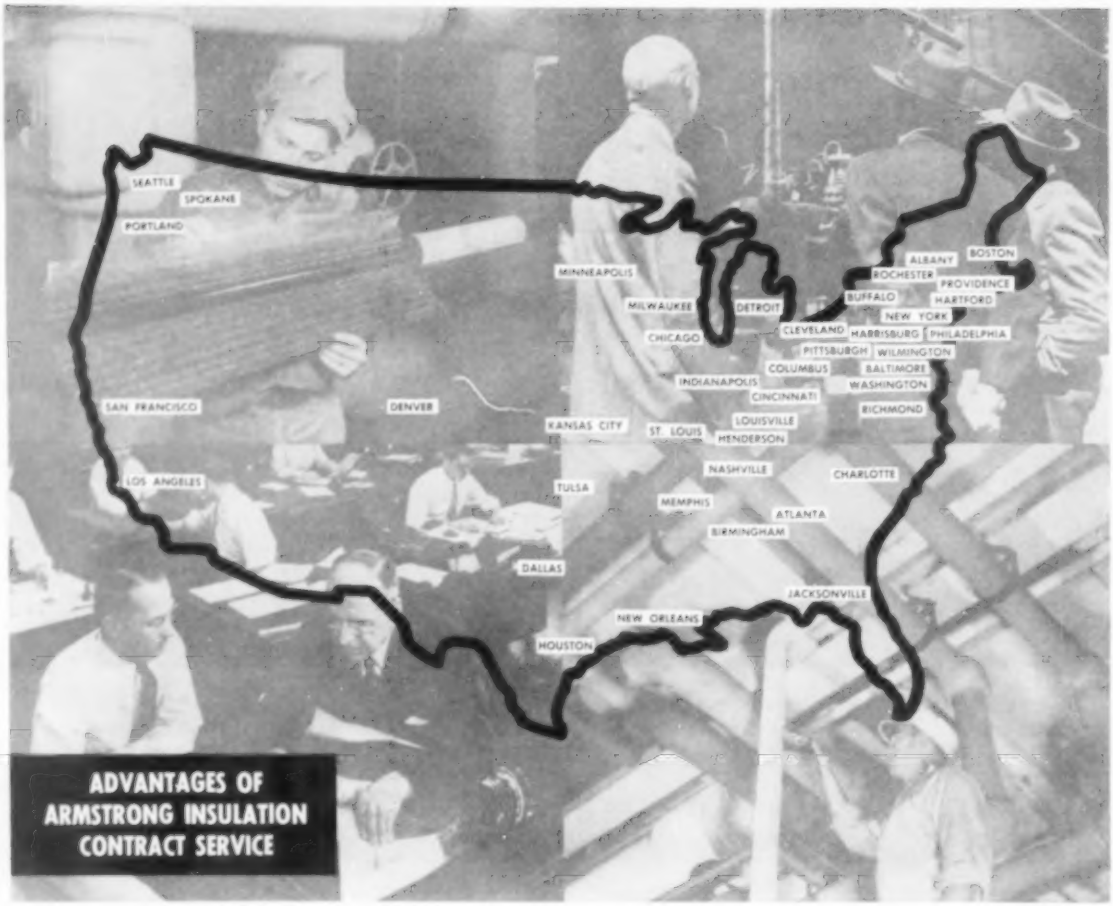
Name _____

Company _____

Address _____

City _____ Zone _____ State _____

(To obtain more data on advertised products see page 916)



Nation-wide service . . . *13 offices give you insulation help anywhere*

No matter where your next insulation job may be, Armstrong can give you efficient, well-integrated, on-the-job service from original specs to final installation.

If your job is some distance from home, Armstrong engineers will help your home office staff develop plans and specifications. Then your decisions will be efficiently carried out by the Armstrong office in the territory where the installation is to be made. An Armstrong engineer is always close at hand, eliminating misunderstandings and long-range communications.

Whether your job requires high- or low-temperature insulations, the Armstrong Insulation Contract Service provides a full line of materials. Experienced engineers, assisted by trained superintendents and foremen, oversee your job from start to finish. And if you have special problems, the facilities of the Armstrong Research and Development Center are always available to you.

Get full information on how the Armstrong Insulation Contract Service can help you from your nearest Armstrong office. For a free booklet on Armstrong Industrial Insulations, write Armstrong Cork Company, 2006 Shannon Ave., Lancaster, Pennsylvania.

Armstrong INDUSTRIAL INSULATIONS

MEETING TODAY'S and tomorrow's REFINING NEEDS

HIGHER OCTANE
HIGHER QUALITY PRODUCTS

LOWER EQUIPMENT COSTS
LOWER OPERATING COSTS

Now is the time to be thinking about the future. Higher compression ratios in 1956 automobiles mean a demand for a higher quality product and with 100-octane gasoline in the near future.

Let us talk with you regarding *catalytic reforming*. You will be interested in knowing how this can help you to meet new octane levels. A telephone call, wire or letter will bring quick response, without obligation. TRECO's expansion program enables us to have the staff to continue to guarantee you a new unit in less than a year.

TRECO
REFINERY ENGINEERING Company
TULSA TORONTO

STATESMEN OF TECHNOLOGY

within the shadows of the ancient Roman Forum an unusual type of diplomacy is at work. Meeting at the Fourth World Petroleum Congress, representatives from many countries have assembled in Rome to discuss mutual problems and to survey the latest developments in the science of petroleum. By this means, the free exchange of ideas and experiences is facilitated among men who are drawn together by the universal desire for progress and success.

And success will be theirs . . . success that will be measured in far greater terms than in the advancement of an industry. For, with their unhampered search for new ideas every member of the Congress becomes a statesman for the free world . . . statesmen of technology . . . and truth.

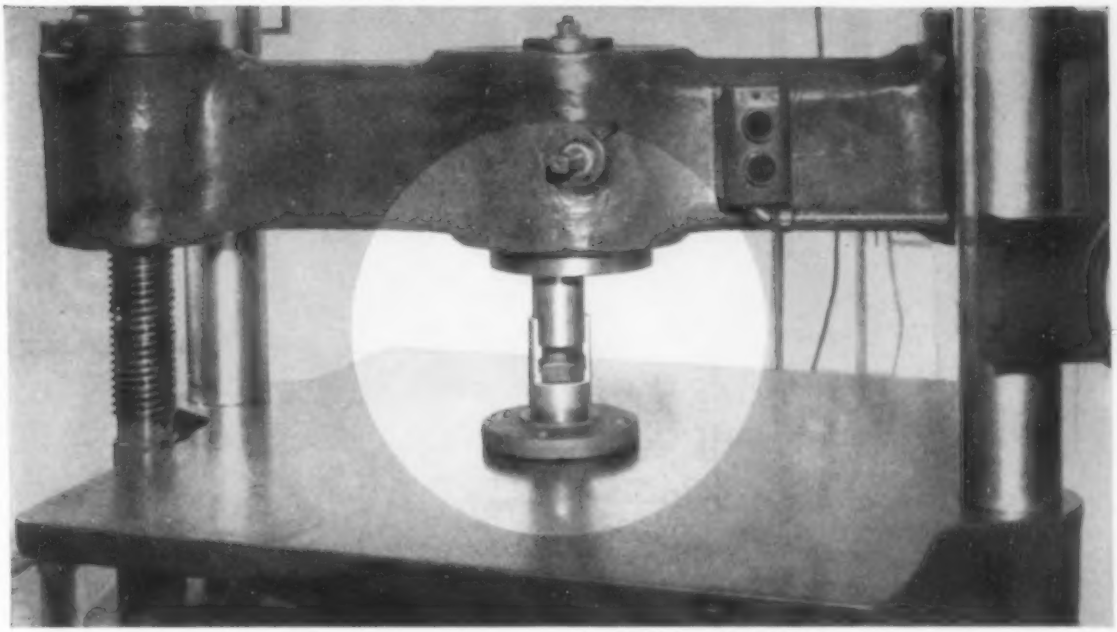
PROCON *Incorporated*

1111 MT. PROSPECT ROAD, DES PLAINES, ILLINOIS

PROCON (CANADA) LIMITED—40 ADVANCE ROAD, TORONTO
PROCON (GREAT BRITAIN) LIMITED—112 STRAND, LONDON

WORLD-WIDE CONSTRUCTION FOR THE PETROLEUM, PETROCHEMICAL, AND CHEMICAL INDUSTRIES

PROCON®



Bond holds despite shear exerted by mandrel on lead lining in test section of "Tubond" pipe.

Now...in "Tubond" pipe...a bond stronger than the tensile strength of lead

National Lead's improved bonding process inseparably weds lead to steel

Squeeze it, abuse it . . . no breaks appear in the casing, lining, or bond.

Twisted once, twisted twice . . . the second time in the reverse direction. No bond failure.

Twist it. Crush it. Manhandle it.

You just can't strip the lead lining away from National Lead's "United Tubond"® lead-lined pipe. The lining will "give" but not the bond.

Look at the test above. Here a mandrel, sized to the ID of the steel pipe minus a few thousandths, is forced through "Tubond" pipe. (A part of the side wall is cut away to show what happens.)

The lead flows, of course, and accumulates below the mandrel. But it doesn't actually pull away from the steel pipe. A thin layer of lead still remains bonded to the steel.

Now look at the twisted and crushed sections. No separation despite massive distortion. With pressure, vacuum, heat, vibration, it's the same story . . . no separation.

What weds the lead to the steel is National Lead's improved bonding process.

Proves virtually indestructible

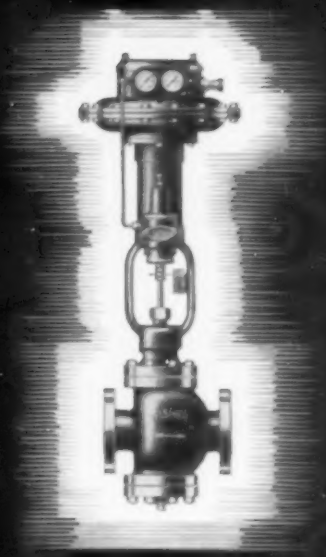
In service, too, this bond provides an anchorage for the lining that minimizes any chance of acid leakage.

So for maximum corrosion protection, coupled with maximum mechanical strength, specify "United Tubond" pipe. Where conditions are less rigorous you may want to look into "United" expanded lead-lined pipe.

National Lead's technical specialists will be glad to help you work out the technical details of corrosion-resistant systems . . . piping, valves, pumps, coils, tanks and other elements. Just call the nearest office below.

NATIONAL LEAD COMPANY. New York 6; Atlanta; Baltimore 3; Buffalo 3; Chicago 80; Cincinnati 3; Cleveland 13; Dallas 2; Philadelphia 25; Pittsburgh 12; St. Louis 1; Boston 6 (National Lead Co. of Mass.); Los Angeles 23 (Morris P. Kirk & Son, Inc.); Toronto, Canada (Canada Metal Company, Ltd.).

(To obtain more data on advertised products see page 916)



FISHER **WIZARD** - - - *UNIVERSALLY ACCEPTED AS THE WORK HORSE ON SIMPLE PRESSURE CONTROL JOBS*

FISHER GOVERNOR COMPANY • Marshalltown, Iowa

WORLD LEADER IN RESEARCH FOR BETTER PRESSURE AND LIQUID LEVEL CONTROL

HUDSON Solo-aire and Combin-aire COOLING UNITS

minimize water consumption in the Pegasus Plant of Magnolia Petroleum Company, Midland County, West Texas

Pictured in the foreground is the HUDSON Combin-aire unit, with Solo-aire units in the background. Air is used directly for cooling in the Solo-aires where low temperatures are not required. The Combin-aire uses a small quantity of water to precool the air so that entering hot fluids may be cooled to effluent temperatures lower than those obtainable by direct use of air.

If the total heat load of this plant had been dissipated thru a conventional cooling tower, 158 million gallons of water per year would have been required for makeup. The actual annual water makeup for the plant is only 17 million gallons per year. In this plant the use of the Solo-aire and Combin-aire have proven advantageous, resulting in savings in first cost, in operating costs for horsepower, water treating, and maintenance, and in obviating necessity for drilling of several water wells. Savings in cost of piping result thru installing the Combin-aire in close proximity to process equipment, made possible because the effluent high temperature air is always under-saturated with water vapor and nuisance and high maintenance cost due to water carryover or condensation are eliminated.

New bulletin
"Cooling with Air"
mailed upon request

HUDSON
ENGINEERING CORPORATION

FAIRVIEW STATION • HOUSTON, TEXAS

Accurate, Automatic Temperature Control

Hudson Solo-aire or Combin-aire units, or water cooling towers may be equipped with Auto-Variable pitch fans. Minute changes in cooled fluid outlet temperature immediately and automatically changes pitch of fan blades increasing or decreasing air flow. Control is effective despite changes in heat load or hot fluid inlet temperature; and over ambient air temperature range of more than 150° F.

Compared with fixed-pitch fans, Hudson Auto-Variable fans effect power *savings* of as much as 85%, depending upon actual versus design air temperatures.

Hundreds of auto-variable pitch fans from 6 to 18 feet in diameter are providing accurate, trouble-free, temperature control without necessity for shutters, louvers or by-passes, and with large power savings.

HUDSON AUTO-VARIABLE PITCH FANS

- **Accurately control temperature.**
- **Effect major savings in power.**
- **Reduce cost of control equipment.**
- **Eliminate by-pass piping.**
- **Prevent freezing even in extremely cold weather.**
- **Operate with standard pneumatic instruments.**
- **Have all moving parts of control mechanism completely enclosed and weather-proofed.**

Hudson designs and manufactures cooling systems using water exclusively, air exclusively, and combinations of air and water. Objective comparisons are furnished without cost.

Hudson Auto-Variable Pitch Fan is protected by U. S. patents and patents pending.

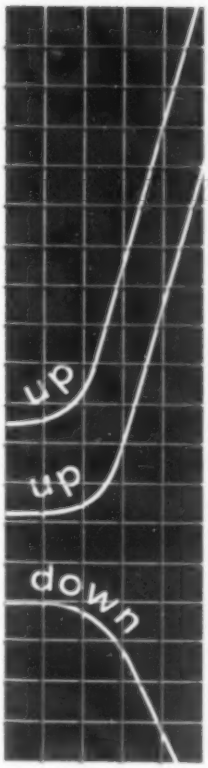
HUDSON
ENGINEERING CORPORATION

FAIRVIEW STATION • HOUSTON, TEXAS

throughput up

quality up

costs down



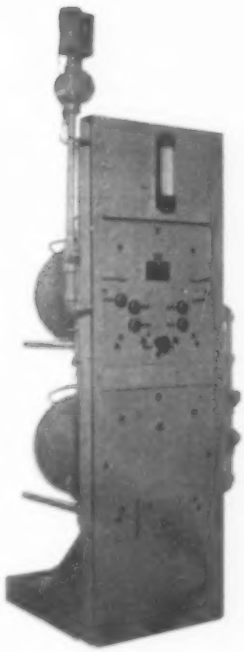
process refractometer

(Type 38-201)

For monitoring or control of fractionating towers and stream-blending operations. Automatic control can be established through completion of composition-actuated feedback loop . . . or information can be telemetered to pen recorders in the refinery control room. SEND FOR BULLETIN CEC 1839-X3.

Here are the first "Consolidated-Phillips" *continuous* process analyzers . . . units which provide analytical data while it's valid, *before* variables have changed. With these two instruments on stream, product quality and production go up . . . costs go down. You can install and maintain them for less, on an hourly basis, than a laboratory technician's salary. They need no elaborate facilities, can operate out-of-doors, are completely explosion-proof.

Consolidated-Phillips process analyzers have been proving their ability . . . and dependability . . . under actual plant conditions for several years. Originally designed and formerly manufactured by Phillips Petroleum Company, they are now backed by Consolidated Engineering's nationwide service organization . . . assurance of interruption-free operation for years to come.



infrared analyzer

(Type 38-101)

Handles up to five streams at a rate of 5 analyses per hour per stream, i.e., 12-minute cycle period. Increases fractionator capacity by holding product composition steady and minimizing operational fluctuations. Eliminates the time lag between sampling and laboratory batch analysis. SEND FOR BULLETIN CEC 1840-X3.

Whether your process instrumentation needs are for a single unit or a complete analysis-and-control system, you'll find it will pay to talk to a CEC Field Engineer. Write us today.

Consolidated Engineering

Corporation

ELECTRONIC INSTRUMENTS FOR MEASUREMENT AND CONTROL

300 North Sierra Madre Villa,
Pasadena 15, California

Sales and Service Offices Located in: Albuquerque, Atlanta, Boston, Buffalo, Chicago, Dallas, Detroit, New York, Pasadena, Philadelphia, San Francisco, Seattle, Washington, D.C.

(To obtain more data on advertised products see page 916)

MOTORISTS KNOW NOTHING ABOUT THESE ADDITIVES BUT THEY'D MISS 'EM IF GASOLINE DIDN'T HAVE THEM

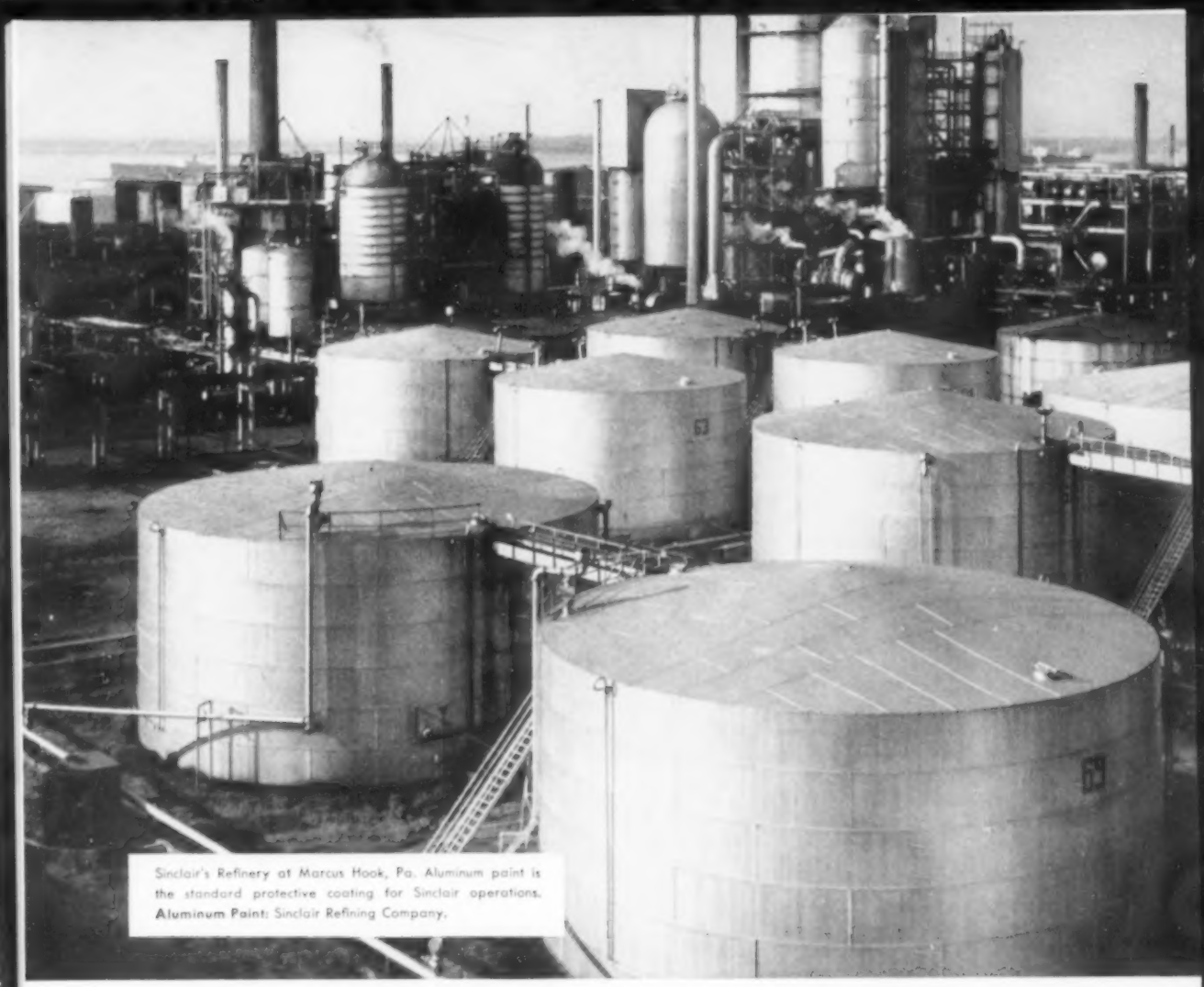
Tenamene

EASTMAN GASOLINE ADDITIVES

Behind the performance of gasoline, the protection of the gum-inhibiting Tenamenes. Behind the Tenamenes, the interested technical service of Eastman—men and company—ready at short notice to solve refinery inhibitor problems on the spot.

SALES OFFICES: **Eastman Chemical Products, Inc.,** Kingsport, Tennessee; New York—260 Madison Ave.; Framingham, Mass.—65 Concord St.; Cincinnati—Carew Tower; Cleveland—Terminal Tower Bldg.; Chicago—360 N. Michigan Ave.; St. Louis—Continental Bldg.; Houston—412 Main St. **West Coast: Wilson Meyer Co.,** San Francisco—333 Montgomery St.; Los Angeles—4800 District Blvd.; Portland—520 S. W. Sixth Ave.; Salt Lake City—73 S. Main St.; Seattle—821 Second Ave.

For more information on Tenamene additives and the service that backs up their proper use, contact our local representative or write to Eastman Chemical Products, Inc., Kingsport, Tennessee—a subsidiary of Eastman Kodak Company.



Sinclair's Refinery at Marcus Hook, Pa. Aluminum paint is the standard protective coating for Sinclair operations. **Aluminum Paint:** Sinclair Refining Company.

In corrosive coastal atmospheres
Aluminum Paint has lasted 15 years for Sinclair Refining Co.

Sinclair has used aluminum paint since 1916. Its unmatched performance through the years in protecting metal, reducing evaporation losses and improving appearance has made aluminum paint the standard protective coating for Sinclair's large refineries. Hundreds of bulk stations, terminals, tank farms and other installations throughout the country are similarly protected with aluminum paint.

On the Texas Gulf Coast, for example, an area conceded to be especially rough on metal and paint, aluminum paint has lasted 15 years and more at Sinclair's South Tank Farm! There is an outstanding testimonial to the remarkable durability and economy of aluminum paint.

ALCOA does not make paint. But ALCOA Aluminum Pigments are used in more aluminum paints than any other brand. Look for the ALCOA shield on the paint that you buy. It's your assurance of top quality and performance in aluminum paints—top protection for installations throughout the petroleum industry.

Write us about your paint problems. Mail the coupon today for our FREE booklets on aluminum paint and aluminum asphalt coatings.

ALCOA ALUMINUM

ALUMINUM COMPANY OF AMERICA

Aluminum Company of America, Paint Service Bureau
1792-F Alcoa Building, Mellon Square, Pittsburgh 19, Pa.

Please send me your FREE booklets, *Painting With Aluminum*, *Aluminum Asphalt Roof Coatings Make Time Stand Still*.

Name _____

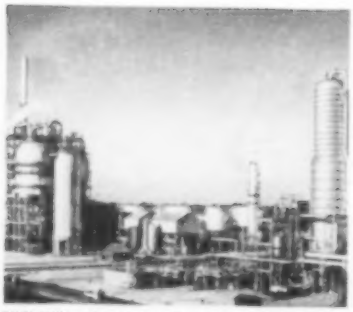
Company _____

Address _____

City _____ Zone _____ State _____

A WORLD OF PRACTICAL KNOW-HOW
in the design, engineering, construction and installation of complete refineries, individual processing units and refinery modernization

CANADA — Complete refinery with capacity of 23,000 barrels per day.



ENGLAND — Largest refinery in Britain, with capacity of 125,000 barrels per day.

UNITED STATES — Synthetic ammonia plant, producing 180 tons of liquid ammonia per day.

(To obtain more data on advertised products see page 916)

What Foster Wheeler's

WORLD-WIDE EXPERIENCE

in petroleum processing

means to you

The sun never sets on Foster Wheeler petroleum processing plants. From U.S.A. to the Philippines — from England to South Africa — modern refineries and processing plants designed and installed by Foster Wheeler are producing, every day, high quality petroleum products for free-world consumption.

During the past year, FW has placed in operation complete new refineries in U.S.A., South America, South Africa and the Philippines — plus many additional processing units including the largest crude distillation unit ever built and the highest capacity fluid cat cracker in the world. Work is continuing on similar projects in Brazil, Venezuela, England, France, Spain, Bahrein, Canada and the U.S.A. These world-wide operations are conducted jointly by Foster Wheeler and their subsidiary companies in Canada, England and France.

The *experience* which all of this represents is of vital importance to petroleum refiners *everywhere*. It means that virtually every forseeable design and construction problem has already been solved under a variety of conditions. Working with and training unskilled labor in far countries has developed streamlined and simplified construction procedures. And this specialized know-how is constantly being expanded, through research and development, to encompass the latest technological advances in the petroleum and chemical processing fields.

This valuable experience can save you time, effort and expense in any phase of refinery design, construction or modernization. *Foster Wheeler Corporation, 165 Broadway, New York 6, N. Y.*

FOSTER WHEELER

COLOMBIA, S. A. — Completely modernized refinery with capacity of 30,000 barrels per day.

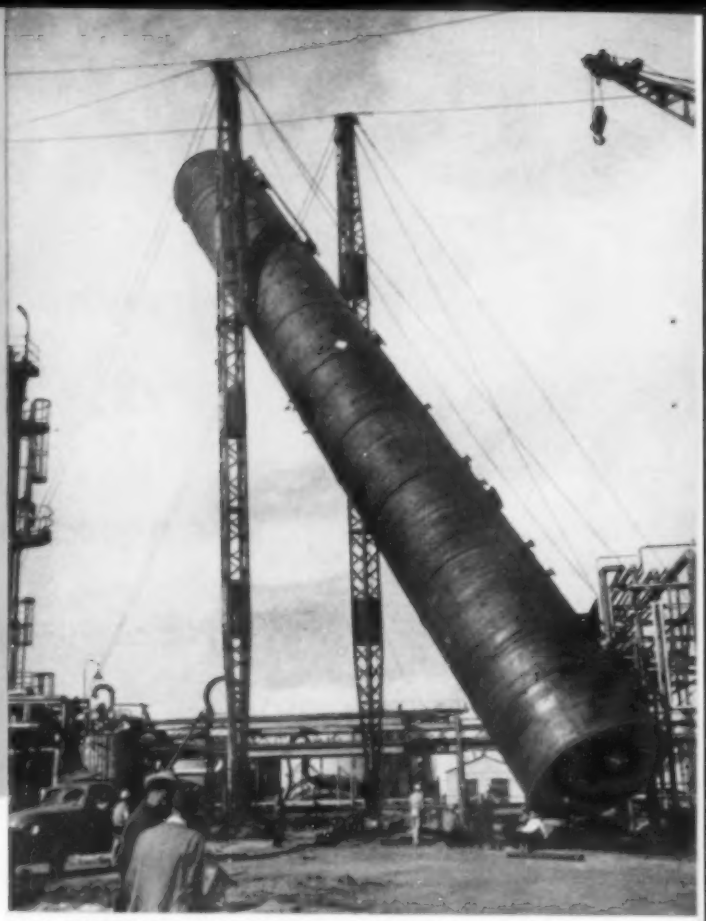
PHILIPPINES — Complete refinery with capacity of 13,000 barrels per day.

SOUTH AFRICA — Complete refinery installation — capacity, 15,600 barrels per day.

(To obtain more data on advertised products see page 916)

One of the first steps in pressure vessel fabrication consists of rolling the plate into curved sections with heavy plate bending rolls like this.

Custom Fabrication For The Process Industries...



A BS&B-Fabricated Phenol Treating Tower goes into place in a large Gulf Coast refinery. Though not the largest made by BS&B, this vessel is fabricated of 7/8" plate, is 13' in diameter by 135' long and weighs 380,000 lbs., including trays.

Partial view of a welding bay in our Oklahoma City plant, showing pressure vessels in various stages of completion.

After fabrication is completed, the pressure vessel must be stress-relieved in this specially built gas-fired annealing oven. It employs a 10-point temperature recorder with thermocouples attached directly to the vessel.

...Takes Plenty Of "Know How", "Know Why", and "Do"!

A lot of engineering talent, modern fabricating equipment, plant facilities and manufacturing skill are required to produce the kind of special equipment demanded by today's Process Industries!

Take the 2300° F. annealing oven at our Oklahoma City plant, for instance. It is among the largest of its kind to be found west of the Mississippi. In it we can stress-relieve units measuring up to 80'-0" in length, 15'-8" in diameter and weighing up to 125 tons!

We are equipped to do submerged arc (automatic), metallic arc (manual), oxyacetylene or inert-gas-shielded metal arc welding to conform to all recognized code requirements, and can fabricate plate thicknesses from 14 gauge through 4½".

Our well-equipped machine shops can fabricate both ferrous and non-ferrous alloys, solid and clad materials. The very latest in quality control, inspection and testing techniques and equipment are in constant use.

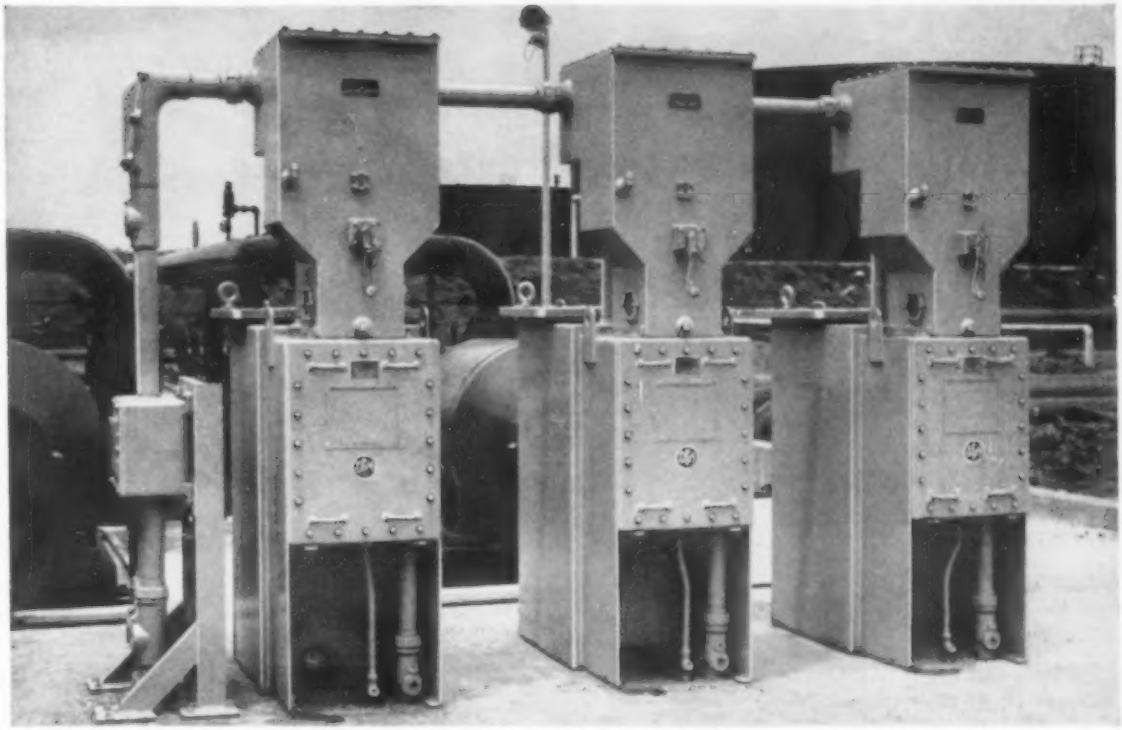
These are some of the reasons why BS&B, with its more than 60 years of service, has become known as one of the industry's leading custom fabricators of *quality* equipment. Why not take advantage of our conveniently located facilities and years of fabricating experience on your next project? Your BS&B Representative will be glad to discuss it with you in strictest confidence. Or write to...

Contract Sales Division, Dept. 5-D6

EFFICIENCY OVER 60 YEARS BS&B RELIABILITY

BLACK, SIVALLS & BRYSON, INC.

2131 So. Westwood Blvd. P. O. Box 1714 Oklahoma City, Oklahoma

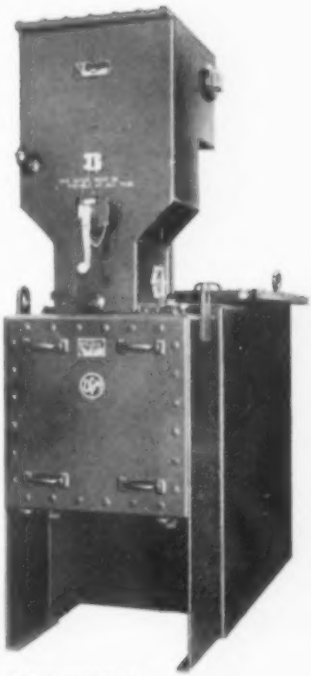


EC&M Starters in operation at large Louisiana Refinery.

FULL PROTECTION FOR VITAL DRIVES with EC&M 2200 - 5000 VOLT Motor Starters

- **SAFE OPERATION** — Starters are designed for requirements of Class I, Group D hazardous locations, with main motor circuits made and broken under oil.
- **HIGH INTERRUPTING CAPACITY** — EC&M Starters are rated at 50,000 KVA interrupting capacity based on *certified tests*. For higher ratings, these starters are built in the VALIMITOR style (oil-immersed reactors limit infinite KVA to a finite value easily cleared by the starter).
- **PERSONNEL PROTECTION** — Combination type with Oil Disconnect Switch has view window on each side to show position of disconnect contacts.
- **MOTOR PROTECTION** — Thermal-Magnetic Overload Relays guard motors by inverse time on overloads . . . trip instantly on fault currents.
- **LUBRICATED AND PROTECTED** — EC&M Starters require infrequent inspection and minimum maintenance because oil immersion protects the starter mechanisms from corrosive atmospheres.
- **COMPACT NEAT INSTALLATION** — Starters require little mounting space, allowing ample room around each unit for inspection and maintenance.

Write for booklet 1062
Describing and illustrating EC&M Motor Starters for petroleum applications.

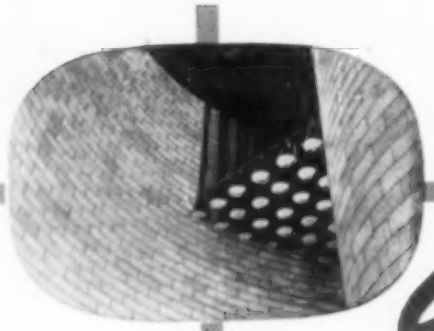


EC&M 2200-5000 volt starter with self-contained oil disconnect switch.

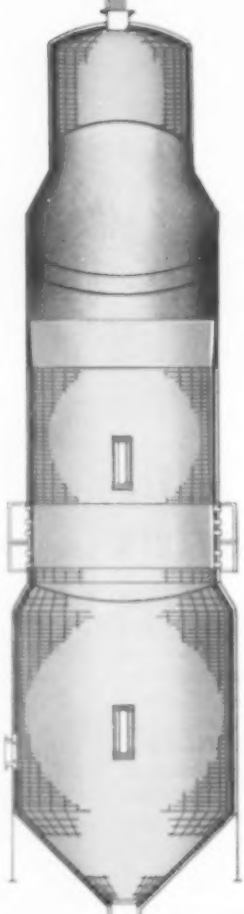
THE ELECTRIC CONTROLLER & MFG. CO.

4498 Lee Road ★ Cleveland 28, Ohio

6025



Engineering Plus



THERMOLAYER CONSTRUCTION

Here is an economical refractory liner for steel cased units. It involves a minimum of labor and provides a maximum of protection over a wide range of temperature. There is a refractory tile surface backed by insulation and a poured sealing layer.

THINSULITE

Construction provides more refractory and insulation which may be varied to suit the unit. Available with 3 and 4½ inch depths of tile.

DETEGRAL

Construction provides tile depths of 7 or 9 inches for more severe furnace conditions . . . backed by variable depths of insulation . . . plus a casing cement for weatherproof exterior finish.

SEVERAL OTHER

Constructions to meet different operating conditions are described in the booklet.

Whatever the type of unit, you can get more for your enclosure dollar through Detrick constructions. They are engineered to suit operation conditions . . . built from 42 years of progress in this field, with materials backed by laboratory research. Detrick's erection service assures you of expected performance from the unit.

There is a Detrick construction designed to meet any combination of combustion conditions in any type of refinery unit . . . from a complex catalyst regenerator, heater or boiler to a simple flue or breeching. In every case the proper materials and methods of application are selected to meet working conditions.

Before you decide on any heat enclosure learn what Detrick can do. Tell us about your project and ask for the booklet.

M. H. DETRICK COMPANY
111 W. Washington Street • Chicago 2, Illinois

DETRICK Heat ENCLOSURES

SEND FOR BOOKLET. Read about the development of heat enclosures for all purposes in "HEAT ENCLOSURE METHODS by DETRICK". A copy is available upon request.

DETRICK
HEAT ENCLOSURES

Another Opportunity to Save with Wolverine Trufin®—
Number 6 of a Series

STEP UP EFFICIENCY

Knock down Costs of Propane-Butane Heat Exchangers

You can boost efficiency—shave costs as well—when you specify Wolverine Trufin Type S/T for new installations or for retubing propane-butane heat exchangers.

On new jobs Trufin can slash total tube requirements and provide greater heat transfer. That's because integral-finned Trufin provides approximately two times more outside surface area (per lineal foot of tube) for condensing than does plain tube. Trufin cuts unit costs even more because less tubing means smaller shells, headers, baffles and less maintenance.

When retubing, Trufin can skyrocket the BTU output of old exchangers. Trufin is mechanically interchangeable with prime surface tube and standard fabrication and installation methods can be used. The tube wall at the plain end is heavier than the standard wall at the finned section providing added rigidity and maximum protection at the header.

Here is graphic proof of how Trufin increases surface area.

	"A" PLAIN TUBE HEAT EXCHANGER	"B" TRUFIN TYPE S/T HEAT EXCHANGER
SHELL SIZE O.D.	34 inch	34 inch
TUBE SPECIFICATION	⅝" O.D. 16BWG Admiralty Plain Condenser Tubing	⅝" O.D. 16BWG Admiralty Trufin Type S/T
TOTAL OUTSIDE AREA OF CONDENSER TUBING	2,885 sq. ft.	6,552 sq. ft.
TOTAL TUBE LENGTH	12,600 feet	12,600 feet

Trufin is available in a wide range of alloys and sizes to meet your specific processing needs. For additional information and case histories of actual Trufin installations write for a copy of Wolverine's Design Manual "Opportunity."

WOLVERINE TUBE
DIVISION OF CALUMET & HECLA, INC.

Buy TUBEMANSHIP**

IN CONDENSER and BOILER TUBE

Buy WOLVERINE!

When you buy electric-welded steel tube from Wolverine you buy the product of Tubemanship. You are assured of condenser and boiler tube designed to deliver maximum performance when the pressure is on. You can count on tubes that are known for long life and dependable service.

Wolverine electric-welded steel tube is recognized as—Qualitube*. It meets all accepted specifications. Flattening, reverse flattening, expanding and flanging of tube sections are some of the torturous tests that help insure constant weld quality. Each condenser tube is also subjected to hydrostatic tests well over a fibre stress of 20,000 psi.

Qualitube is available in prime surface or with integral fins. It can be fabricated to your specifications and can be held to exceptionally close tolerances. It has a clean, flash-free surface.

Prime surface Qualitube comes in a wide range of sizes and in the following analyses: 1010, 1015, 1020, 1025 and 1030.

Next time your new installation or replacement requirements call for electric-welded steel tube insist on Wolverine Qualitube—reap the long life and the dollar-saving economy of tubing made the Tubemanship way. For complete information write for the Wolverine Steel Tube Catalog.
WOLVERINE TUBE, 1441 Central Avenue, Detroit 9, Michigan.

Tubemanship—

a Wolverine-coined word standing for constant research, rigid quality control, sound engineering and the work of skilled craftsmen.

Wolverine Trufin is available in Canada through the Unifin Tube Company, London, Ontario

WOLVERINE TUBE
DIVISION OF CALUMET & HECLA, INC.

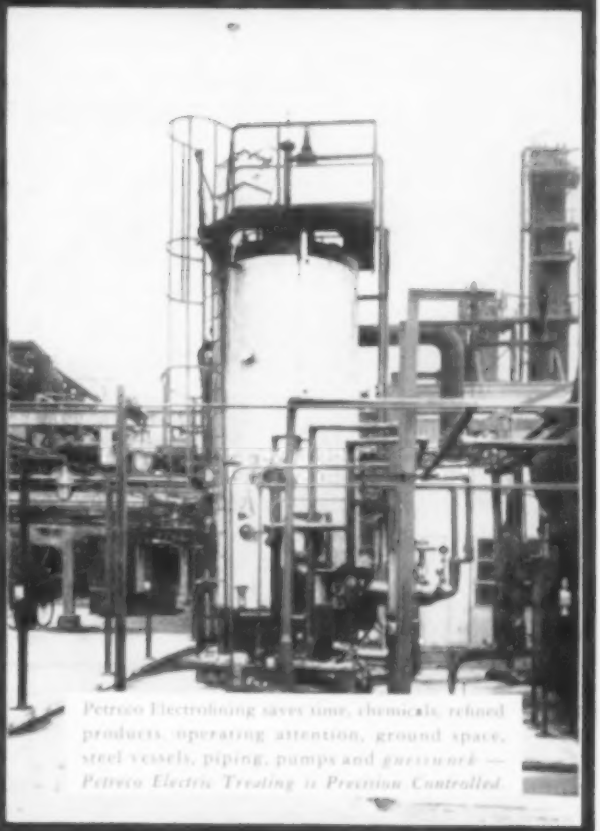
PLANTS IN DETROIT, MICHIGAN, AND DECATUR, ALABAMA
SALES OFFICES IN PRINCIPAL CITIES

A New Concept in Distillate Treating

PETRECO

ELECTROFINING

The Petreco Electrofining equipment provides one pass operation, more intensive contact and minimum entrainment loss. It holds chemical (acid, caustic, doctor solution) consumption to a minimum. In addition to these advantages, Petreco Electrofining is carried on in a single, closed unit, and is a continuous, automatically controlled process. In treating the average kerosine, gasoline or gas oil stream, one small Petreco unit will usually replace three or four 10' x 30' (or larger) vessels.



Petreco Electrofining saves time, chemicals, refined products, operating attention, ground space, steel vessels, piping, pumps and *guesswork* — Petreco Electric Treating is Precision Controlled.

Specialized Electric Petroleum Processing

DESALTING • DEHYDRATING
DISTILLATE TREATING • LUBE OIL TREATING • SEDIMENT SEPARATION
DESAPONIFICATION

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PETRECO

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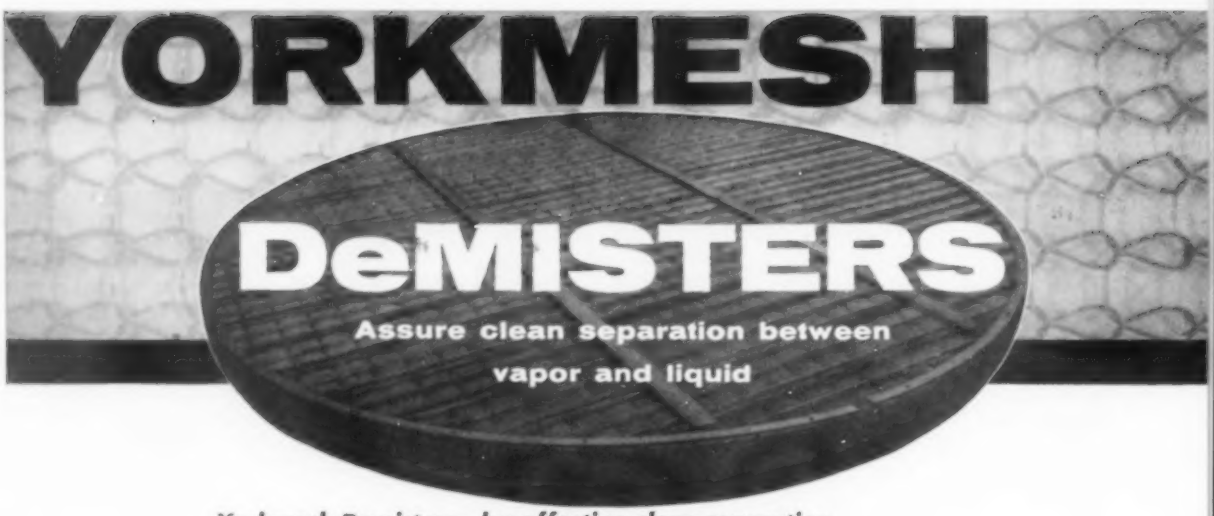
DT-3

YORKMESH



Yorkmesh Demisters—by effecting clean separation between vapor and liquid—improve the performance and increase the throughput capacity of any process vessel handling both liquid and vapor phase materials.

Yorkmesh Demisters are knitted wire mesh pads, available in a variety of types, sizes and materials. The unique fine wire construction provides flexibility, resiliency, light weight, high structural strength and extensive surface area. These Demisters are supplied to the exact size and shape required and are usually furnished mounted on light weight open type support grids. Installation is simple in both new and existing equipment.

Vapor-liquid separation efficiency with Yorkmesh Demisters in process vessels is always very high, usually in excess of 99.9%. Where Yorkmesh Demisters are installed in evaporators, distillation columns, gas filters and absorbers, liquid entrainment is substantially completely eliminated.

Pressure drop is so low that it is nearly always negligible. At atmospheric pressure vapor velocities between 2 and 12 ft./sec. are recommended. Under vacuum, depending on conditions, vapor velocities of 30 ft./sec. and higher are possible.

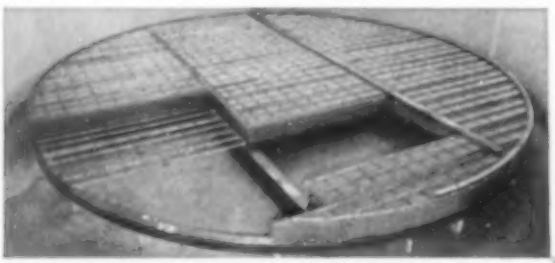
Yorkmesh Demisters are fabricated in a wide variety of materials, densities and wire mesh constructions which are selected to give best performance for the particular operating conditions.

Yorkmesh Demisters are available for prompt delivery in the following materials:

Types 304, 316, 317, 410 and 430 stainless steel
Monel, nickel, Inconel
Aluminum (56-S wire alloy)
Low carbon steel, copper, brass
Also available in Carpenter 20 stainless, Hastelloy B & C, tantalum etc.

The wide experience of the Otto H. York Co., Inc. with thousands of demisters in service provides a sound basis for recommendations that assure the most economical and efficient type of demister for each application. Call on York to solve your problems in vapor-liquid separation.

Complete catalog and list of technical literature (TL54) free on request.



SECTIONAL CONSTRUCTION—recommended for large vessels and for all applications requiring installations through a manhole.

ONE-PIECE CONSTRUCTION—recommended when installation can be made through end of vessel.

 (To obtain more data on advertised products see page 916)

Increase throughput capacity!
Improve process efficiency!
Improve overhead quality!
Reduce contamination!
Stop costly liquid loss!

Yorkmesh Demisters are being used successfully in all types of process vessels handling both liquid and vapor phase materials. Some typical examples—

VACUUM TOWERS:
To increase throughput and improve quality of gas oil by separating entrained asphalt. To decrease metals contamination of gas oil. To improve quality of lube distillates.

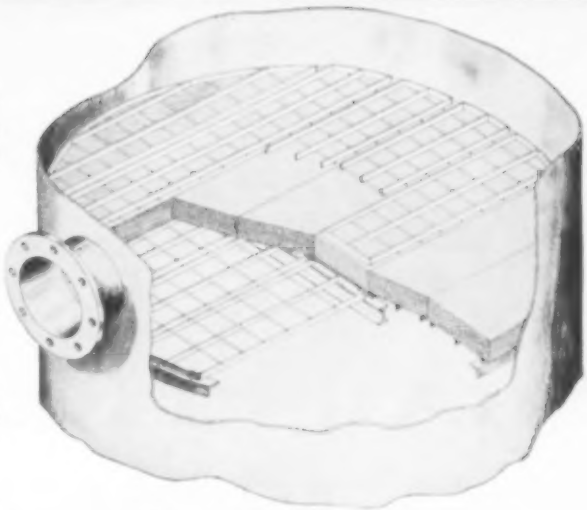
DISTILLATION:
To remove entrained liquid fatty acids from fatty acid vapors. To improve quality of organic product while increasing production. To eliminate glycerin losses.

FLASH TOWERS:
To recover clean naphtha from asphalt solutions. To separate propane from asphalt.

ABSORBERS:
To remove absorption oil from natural gas. To prevent loss of glycol and amine solutions.

EVAPORATORS:
To produce high purity steam from concentrated caustic soda solutions. To stop entrainment losses from valuable fluoride solution.

KNOCK-OUT DRUMS:
To remove water and oil from air. To remove fatty acids from superheated steam. To reduce compressor maintenance by removing liquid entrainment from the gas.



SECTIONAL TYPE DEMISTER IN PLACE—cutaway view.

STEAM DRUMS:
To eliminate liquid entrainment in order to produce high quality, high purity steam.

GAS FILTERS:
To clean manufactured gas. To separate sulfuric acid and solids from chlorine gas.

COMPRESSORS:
To separate entrained liquids from compressor discharge gasses.

SCRUBBERS:
To separate water from natural gas. To eliminate mist from flue gas. To remove natural gasoline from natural gas.

HOW TO GET THE BEST PERFORMANCE—

Send us details on type of process vessel or operation (absorber, vacuum tower, evaporator, knock-out drum, etc.); vapor flow rate, pressure, temperature, and density or molecular weight; liquid rate, viscosity, and specific gravity; for existing equipment advise dimensions, indicate vertical or horizontal vessel, and material of construction required. Furnish a drawing or sketch if possible. Complete details will enable us to make a precise recommendation and price quotation.

YORK

OTTO H. YORK CO., INC.
6 CENTRAL AVE. • WEST ORANGE, N. J.
"clean separation between vapor and liquid"

(To obtain more data on advertised products see page 916)

Every week Harshaw produces carloads of catalysts, and every week we produce orders of only a few pounds for customers' experimental purposes. Whether your catalyst requirement is measured in tons or pounds, we have modern facilities for giving you exactly the catalyst you want. If you are in the experimental or development stage and need only a few pounds of your catalyst, call for our technical assistance; if you are in the production stage, call on Harshaw to produce any amount of catalyst you need. Our ability to produce will provide the catalyst... when you want it. If your mind's on catalysts, call Harshaw today.

HARSHAW produces carloads of catalysts *every week*

HARSHAW

Write for our free booklet, "Harshaw Catalysts"

HARSHAW CATALYSTS AVAILABLE IN 7 FORMS

- Tablets
- Extrusions
- Powders
- Spheres
- Granules
- Rings
- Flakes

THE HARSHAW CHEMICAL CO.

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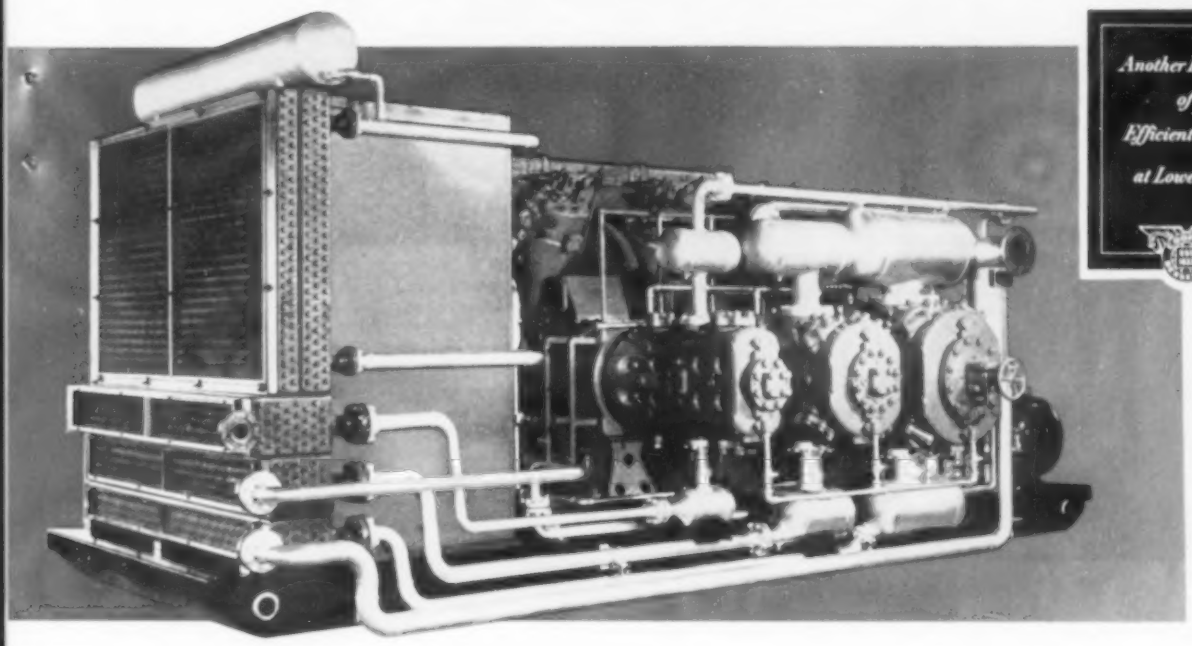
for all compressor services up to 660 hp . . . find out about the



Another Example of Efficient Power at Lower Cost

NEW COOPER-BESSEMER Packaged GMXD

• DEVELOPED FROM A PROVEN DESIGN

With the introduction of the packaged GMXD, Cooper-Bessemer presents to the oil and gas industry a complete, easily installed and highly efficient compressor package—offering big savings on operating expense and installation cost.

The new GMXD offers the many advanced engineering features of the Cooper-Bessemer V-angle design . . . . complete with all auxiliaries and piping—ready to go to work.

Improving upon the field-tested and industry-accepted GMX, a few of the outstanding GMXD advantages include . . . lower peak firing pressures and reduced exhaust gas temperatures . . . unmatched balance for extremely smooth-running performance . . . higher scavenging air ratios at all loads . . . high allowable compressor piston rod loading . . . small space requirements per horsepower . . . and ample working space around power and compressor cylinders.

• PACKAGED BY SOUTHWEST INDUSTRIES

For fast service and delivery . . . in the heart of the oil and gas country . . . packaging of the Cooper-Bessemer GMXD is handled in Texas, Louisiana, Arkansas, Oklahoma and New Mexico:—by Southwest Industries, Inc., Houston 7, Texas. In these five states, GMXD quotations can be procured from either Southwest Industries or any Cooper-Bessemer office.

MOUNT VERNON, OHIO

COOPER-BESSEMER

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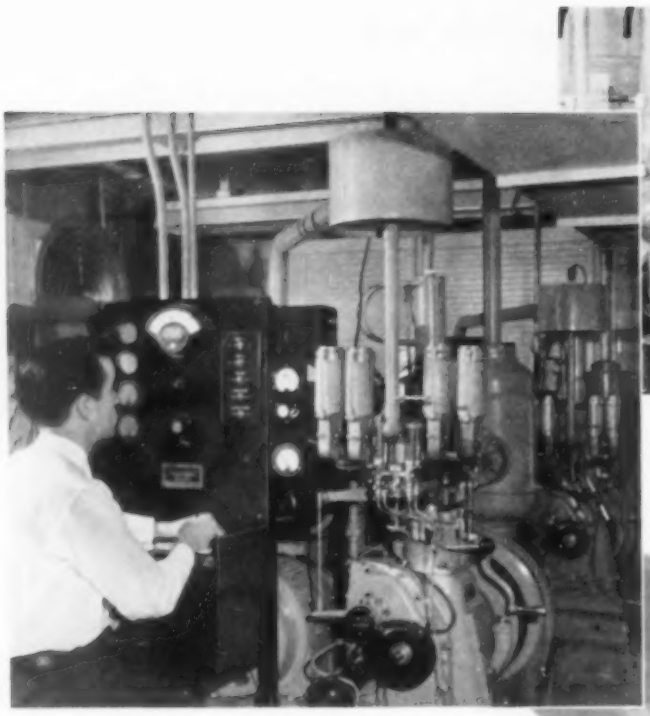
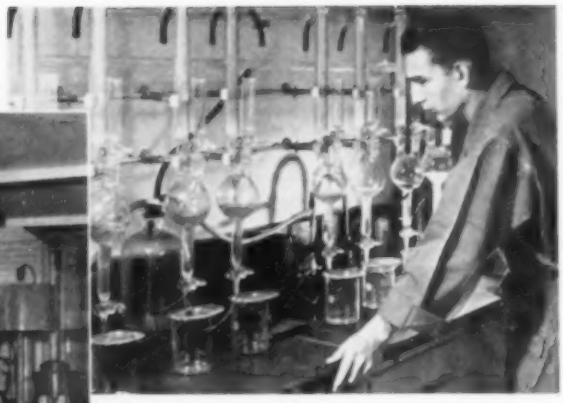
New York City • Seattle, Wash. • Bradford, Pa. • Chicago, Ill. Houston, Dallas, Greggton, Pampa and Odessa, Texas Washington, D. C. • Shreveport, La. • San Francisco, Los Angeles, Calif. • St. Louis, Mo. • Gloucester, Mass. • New Orleans, La. • Tulsa, Okla. • Cooper-Bessemer of Canada Ltd., Edmonton, Alberta—Halifax, Nova Scotia

DIESELS • GAS ENGINES • GAS-DIESELS • ENGINE-DRIVEN AND MOTOR-DRIVEN COMPRESSORS





Anybody want an extra laboratory?

We've got five of them conveniently located in the major refining areas of the country. They're not exactly "extra" because they do have a purpose—to meet your needs. They are staffed and equipped to test products, and handle almost any problem involving the use of additives.

These laboratory facilities are one of the 23 or more helpful services the Du Pont Petroleum Chemicals Division offers you.

On call...

Twenty-three helpful services!

Du Pont's comprehensive services are as close and as handy as the telephone on your desk. In a matter of minutes you can have assistance in more than a score of them—technical, safety, and marketing.

Are *you* taking full advantage of this fact?

If not, the chances are that you can save your company, and yourself, considerable time, effort and money, by supplementing your own operations with these many, varied, and helpful aids.

Check over the list on the opposite page. See if there isn't some way we can help you out—right now. Then just pick up your phone (or write) and tell us your wishes.

E. I. DU PONT DE NEMOURS & CO. (INC.) Petroleum Chemicals Division

How much time can *you* save by letting us do these things for you?

Technical

1. Regional laboratory services for work on problems involving the use of additives.
2. Blending plant design and construction engineering services. These include complete plans and special consultation.
3. On-the-road performance testing of your products by Du Pont Fuel Test Cars.
4. Fleet customer service by engineers ready to help you solve a fuel performance problem for a big customer.
5. Research is one of our long suits at Du Pont. If a particular problem is bothering you, perhaps our work can supplement yours for a quicker solution. Ask us about it.
6. Our specialized knowledge of chemical additives is always at your service. Whenever unusual problems arise, our chemists or engineers will be glad to lend you a hand in helping find the solution.
7. Technical literature covering many facets of additives use and research are available from Du Pont.
8. Improved tetraethyl lead handling equipment, such as the Metal-Flex unloading hose and the TEL Siphon Starter, has been designed and made available to the industry by Du Pont.

Safety

9. The Lead Hazard Clinic, covering all phases of safe TEL handling, makes an ideal supplement to your own training courses.
10. Easy-to-understand visual aids, such as our "Tank Talk" cartoon booklet, are excellent safety reminders for your personnel.
11. Stand-by service at tank entries, is quickly obtainable from Du Pont by telephone or telegraph.
12. "Maintaining Hygiene in Tetraethyl Lead Operations," written by 3 Du Pont doctors, is an authoritative book for your medical staff.
13. Speakers service—our medical personnel will be glad to address your employee safety meetings on the safe handling of TEL.
14. Movies on safety and other subjects can be readily obtained from Du Pont.

Marketing

15. Our new nationwide survey—"The Service Station Operator" gives dealer attitudes on such subjects as customer credit, dealer meetings, price wars and many other important aspects of service station operation. The first of five reports is now available.
16. Service station customer buying habits have been thoroughly studied in our documented survey, "The Service Station and the Motorist." It probably contains many of the answers you are looking for.
17. Visual aid presentations prepared by Du Pont, make ideal material for use in your dealer meeting programs.
18. Customer complaints about gasoline quality can be handled in a salesmanlike way by your dealers. We have a new movie, "When the Customer Says 'KNOCK,'" and a series of folders showing that "knock" is seldom the fault of the gasoline.
19. Advertising and sales promotion kits, prepared by Du Pont, can help you capitalize the advantages of additives in your fuels and lubricants.
20. The Du Pont quarterly survey of gasoline quality keeps you up to date on competitive octane standings and TEL content.
21. Our cartoon movie, "What Makes A Gasoline Good," can be used to show dealers and customers how quality is built into gasoline.
22. To help keep your dealers informed on the latest technical advances, members of our technical staff are available to address your meetings on a variety of subjects.
23. For your industry public relations, Du Pont contributes such programs as the "Magic Barrel Show."

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. . . through Chemistry

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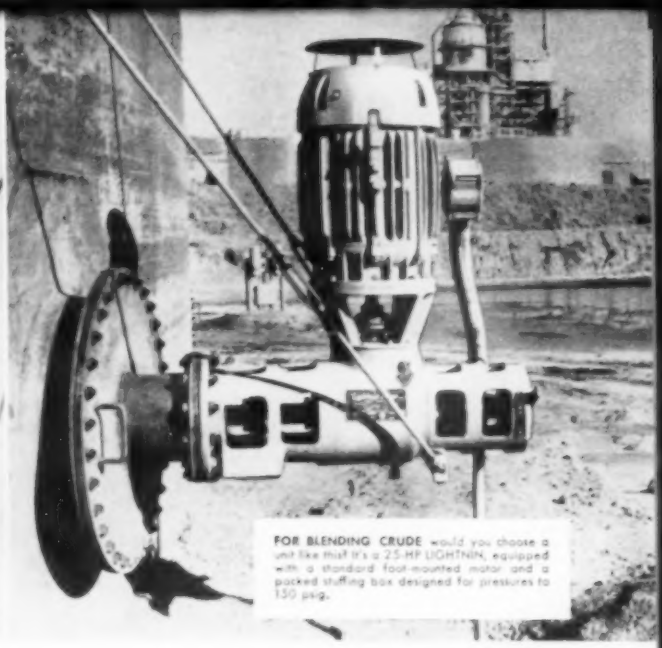
HOUSTON, TEXAS, 705 Bank of Commerce Bldg.	Phone Blackstone 1151	80 Richmond Street, West
LOS ANGELES, CALIF., 612 So. Flower St.	Phone MAdison 5-1691	Toronto 1, Ontario

OTHER COUNTRIES: Petroleum Chemicals Export—Nemours Bldg., 6539—Wilmington 98, Del.

Wilmington 98, Delaware

FOR TEL ADDITION, would you select this 25 HP LIGHTNIN with standard flange-mounted motor? Instead of a stuffing box, this mixer has a quickly replaceable rotary seal cartridge that eliminates repacking entirely, and is lubricated by the liquid in the tank.



FOR BLENDING CRUDE would you choose a unit like this? It's a 25 HP LIGHTNIN, equipped with a standard foot-mounted motor and a packed stuffing box designed for pressures to 150 psig.

How to match **any given set** *of mixing or blending conditions*

Which mixer would *you* specify for a big blending job?

These pictures show just *two* ways you can buy LIGHTNIN Mixers to suit a specific mixing or blending operation.

There are many, many more ways to do this. For example:

MOTORS. You can order LIGHTNINS with the motor that gives you best service and minimizes your stock requirements: any make with NEMA frame, any current characteristics; any enclosure or insulation.

DRIVES. You can choose a highly efficient gear drive, or a lower-cost V-belt drive, for power input to the mixer. On gear drive LIGHTNINS, you can have a fluid coupling between motor and drive to handle excessively high starting torques.

SHAFT SEALING. You can specify the new rotary seal mentioned above (it's saving many oil companies several thousand dollars a year on maintenance). Or you can have your pick of *four* standard packed stuffing boxes, two of which permit repacking without draining the tank.

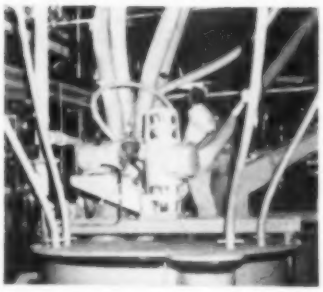
SIZES. You have a full range of sizes to choose from—18 basic models, 1 to 25 HP—so you get a mixer closely fitted to your needs.

MATERIALS. And you can write your own ticket on corrosion-resistant materials for shafts and propellers. You can get these wetted parts in *any* machinable metal or alloy—and with special covering if you want it.

You don't pay more for this freedom of choice. You *save*—because you cut your mixer operating, maintenance, and parts-stocking cost for *as long as the next 20 years.*

That's why it pays to look for the mixer that gives you *most choice* for the money.

Your LIGHTNIN Mixer representative will help you find it—quickly, without obligation. His name is in your copy of Refinery Catalog. Why not call him today?



GET THE ONE correct flow pattern that can give optimum fluid mixing results—with turbine-type LIGHTNINs for open or closed tanks. Hundreds of power-speed combinations are available, in sizes from 1 to 500 HP. Results guaranteed.

OPEN TANK becomes an efficient mixing vessel when you add a LIGHTNIN Mixer. Propeller unit, one of 30 models ranging from ¼ to 3 HP, tumbles and rotates the batch rapidly to achieve uniformity in least possible time.

Get these helpful facts on mixing: cost-cutting ideas on mixer selection; best type of vessel; installation and operating hints; full description of LIGHTNIN Mixers. **Free**—no obligation. Just check data you want, tear out and mail to us today with your name and company address.

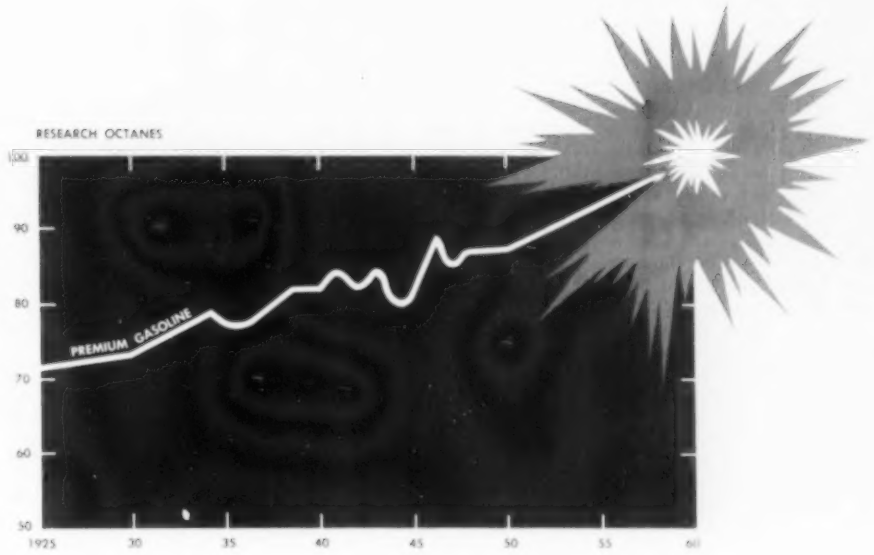
- ☐ B-102 Top Entering Mixers (turbine and paddle types)
- ☐ B-103 Top Entering Mixers (propeller types)
- ☐ B-104 Side Entering Mixers
- ☐ B-107 Mixing Data Sheet
- ☐ B-108 Portable Mixers (electric and air driven)
- ☐ B-110 Condensed Catalog (complete line)
- ☐ B-111 LIGHTNIN Rotary Mechanical Seals
- ☐ B-112 Laboratory Mixers

MIXING EQUIPMENT Co., Inc., 131-f Mt. Read Blvd., Rochester 11, N. Y.
In Canada: Greey Mixing Equipment, Ltd., 100 Miranda Ave., Toronto 10, Ont.

Lightnin® Mixers™

MIXCO fluid mixing specialists

Petroleum Processing
JUNE 1955



When Octanes Break 100 . . .

How Will We Measure Knock?

There is no longer any question of "If" in the matter of octanes going beyond 100, but rather a question of "When?" or "How soon?"

This rapid advance in rating spurs the need for finding a new and widely acceptable method for expressing antiknock values when octane numbers go above 100, the top of the yardstick now in use. It also means there is a need for more precise ratings, particularly in the higher ranges, than those now in use for standard knock tests.

Refiners have a big stake in the problem because of the high cost of building more antiknock qualities into their motor gasoline products. The closer that ratings approximate actual road performance requirements, the less likelihood there is of the refiner overproducing on antiknock qualities.

The public, too, has a stake in the situation. For many years, the motorist has been "sold" on octane numbers as the hallmark of quality in the gasoline he buys. He will have to be educated if another scale is to be used.

Current developments in petroleum and automotive technical circles are here discussed, along with why more precision in test methods is needed and what such precision can mean to the refiner in cost savings. THE EDITORS

A PROJECT to find a scale for expressing fuel antiknock ratings in the range above 100 octane which will be acceptable to both the petroleum and automotive industries was launched at a meeting in Detroit April 26.

The conference, sponsored by the Coordinating Research Council, joint research agency of the American Petroleum Institute and the Society of Automotive Engineers, was presented with concrete proposals for a yardstick for motor fuels when they reach the higher antiknock values. No changes in the standard knock test methods nor in the standard laboratory test engine are contemplated in this project.

A note of urgency was expressed at the Detroit meeting, because the need for expressing fuel antiknock quality above 100 is already evident. Research departments of oil and automotive

companies, in their work with the products that will be commercial fuels in the future, are using different means for rating gasolines, which makes comparison of results difficult.

Commercial premium gasolines today average 95 Research octane number nation-wide and some oil companies are expected to introduce 100-octane fuels by 1958. Any new method proposed, which is accepted by the technical group heading the project, must be approved first by the Cooperative Fuel Research Committee, then by the two industries at large, and then adopted by the American Society for Testing Materials, before it becomes a standard rating scale. This procedure must needs be time consuming.

Two years ago, the Coordinating Research Council presented two possible methods for extending the yardstick for antiknock values above 100 to the research divisions of the oil companies and automotive engine manufacturers. CRC suggested that both methods be used experimentally, and data collected to aid in the later consideration of a new rating scale for general use. These two methods, and another one proposed by the General Motors Corp., received the most attention at the recent Detroit meeting. These methods uniformly proposed that reference fuel for ratings above 100 be isooctane and added increments of tetraethyl lead.

One CRC suggestion was that the Army-Navy (AN) system of performance numbers for aviation gasoline be used, adapted to automotive instead of aircraft engines, and using Motor and Research knock test methods in place of the Standard Aviation and Supercharge methods used with "Avgas."

The AN method for rating aviation gasoline above 100 octane was developed in 1942 to meet wartime needs. The performance number shows the percent increase in rated engine horsepower, at the antiknock level, which is secured by adding TEL, over that developed with isooctane alone. If 10% additional power is secured with a specified amount of TEL, the performance number by the Aviation test method would be 110. It would be different with the Supercharge knock test method, just as ratings for motor gasoline by the Motor and Research methods vary.

Performance numbers are not directly related to octane numbers. For fuels below 100 octane, performance numbers are lower than octane numbers. The method of designation of the grade changes from octane to performance numbers at 100 octane.

The other CRC proposal receiving considerable attention at the Detroit conference was an extrapolation of the present octane scale above 100, using an equation containing the factors of isooctane plus TEL and performance numbers for a conversion to octane numbers. The CRC two years ago submitted this suggestion to the oil and automotive engine laboratories, along with the proposal to use some revised form of the AN performance numbers for rating antiknock values above 100 octane. Some of the oil company research laboratories have worked out their own formula for extrapolation, and data on their work also was thrown into the hopper at the Detroit meeting.

The General Motors method proposed at the Detroit conference is based on the AN performance number rating. However, in place of using full rated horsepower as the performance criterion, as with aviation gasoline, GM suggests some percentage of rated horsepower be used as more typical of actual automotive engine operating conditions. Ratings would be converted into octane numbers under this proposal.

The various proposals and discussions given at Detroit were taken under study by a small group, of which A. W. Backman, Chrysler Corp., is chairman. Mr. Backman also presided at the general conference. The report of this group, with possible recommendations, will be submitted to the 60 members of the Cooperative Fuels Research Committee. After approval there, it will go to the oil and automotive industries for discussion through their technical societies, and also to the ASTM, which must take the final action incorporating any changes into standard test procedures.

More Precise Tests Are Needed

Coincident with the CRC program to extend the octane rating scale above 100, work has been stimulated to develop more indicative and precise antiknock ratings, whether in octanes or other values, from the present standard knock test methods. This may lead to a review of the test procedures and of the ASTM-CFR laboratory knock test engine, to determine their adequacy for rating fuels in the higher antiknock range particularly.

The impetus for this program comes from the recognition of the high cost to refiners of building additional antiknock values into their gasolines as octane numbers reach or exceed 100 octane. The closer the laboratory method for establishing knock ratings approximates actual road performance, the more accurately the refiner can control the quality of the fuels he manufactures to his customers' needs. The more precisely antiknock ratings can be expressed, the more the refiner is spared from overproducing antiknock quality to be sure his product comes within the required specifications.

Technical Committee A of ASTM's Committee D-2 on petroleum products has called the attention of CRC to the fact that motor gasolines are approaching the level at which current ASTM procedures for knock rating, or possibly the equipment used in the procedures, may no longer give adequate results. Substantial changes in the design of the test equipment may be required before satisfactory new methods can be developed, it was brought out.

Technical Committee A therefore recommended to the CRC that, in addition to its current work on motor fuel ratings, it consider a program to investigate possible redesign of the equipment, or the use of alternate equipment, with the objective of overcoming any limitations inherent in the present ASTM-CFR engines.

Improvement in knock test procedures and equipment may come from a project to develop a new basic knock test unit "incorporating all current engineering and knock test knowledge," which has been accepted by Research Division 1 of ASTM Committee D-2. The proposal came from Humble Oil and Refining Co. and included suggestions for specific mechanical changes in the standard laboratory knock test engine. This work was commented on in a paper by M. R. Morrow, Humble Oil and Refining Co., presented at the API Refining Division meeting in St. Louis, May 11: "Incentives for Precise Test Methods: The Case for a New Basic Knock-Test Unit." Mr. Morrow said:

"The problem of knock testing of aviation gasolines was studied in 1952 and 1953 by the Armed Services-Industry Group on Fuel Rating," it was stated. "The need for improved knock testing of aviation fuels was recognized and the ASTM was asked to sponsor an investigation aimed at improvements in laboratory knock-test methods for aviation gasoline evaluations.

"A new approach to knock testing involving the temperature and density of end gases during combustion was considered and made available for fur-

ther study. Research Division 1 has continued the study of the temperature-density concept. If successful, this approach could provide the desired precision on all four knock test methods, viz., Research, Motor, Aviation and Supercharge rich."

The proposed mechanical changes in the knock test engines are for (1) improved maintenance, (2) greater uniformity in equipment and operating conditions, and (3) certain changes in the engine accessories to correlate with the alterations in the engine itself.

"A redesigned cylinder with a demountable head appears to be the improvement most desirable from the standpoint of giving relief to the testing laboratories; i.e., furnishing a greater measure of control over some of the idiosyncrasies of the test engine," it was stated.

Product Costs Drop as Accuracy Is Improved in Gasoline Blending and Testing

(Based on assumption of U.S. motor gasoline production at 2,500,000 b/cd)

Case	I	II	III	IV	V	VI
Probable Period in Effect	—1930's—			—Current— Sgl. Test	Mult. Test	Desired in future
Blending precision[1]	1.0	1.0	1.0	0.5	0.5	0.5
Testing precision[2]	0.8	0.8	0.4	0.4	0.2	0.1
Blends accepted by test which are actually below specification in ture quality, %	25	5	5	5	5	5
Cost of product reblending, testing, and quality giveaway, $/1000 bbl.	26	61	47	31	24	18
Same costs, $1000/cd. for U.S.	—	—	—	78	60	45
Same costs, $1,000,000/yr. for U.S.	—	—	—	28	22	15

[1] Standard deviation in blending.
[2] Standard deviation in knock testing.

And Precise Tests Mean Savings

Savings to refiners of $12,000,000 a year in their cost of manufacturing gasoline are possible through more precise laboratory knock test methods, M. R. Morrow, Humble Oil and Refining Co., stated at the meeting of the API Refining Division in St. Louis, May 11.

Half of this saving, he said, could be realized if refiners used multiple testing with the present standard knock test methods. Multiple testing is running two or more tests, to reduce the errors through running only one test. The more precise averaged results make it possible to reduce the tolerance otherwise necessary to assure meeting product specifications.

Improvements in the precision of present test techniques would be required to realize the other $6,000,000 saving, Mr. Morrow stated.

Supplies of aviation fuels could be increased, and costs reduced, if more accurate knock test methods were available.

The dollar savings to refiners are based on estimates the Humble company prepared, showing the reduction in costs of reblending, testing, and overproducing on antiknock quality which are possible by smaller deviations in product quality from specifications where the tests used for control in manufacturing and blending are more precise.

While blending and testing techniques were being developed in the early 1930's, the paper states, standard deviation values for octane quality were about 1 octane in blending and 0.8 octane in testing. "With these high values, the material accepted by test but below specification in true octane quality could be as high as 25%. In such cases complaints on quality of the product were frequent. . . . To prevent excessive rejection rates on testing, blends were prepared to meet a target quality well above specifications."

Through the years blending operations have improved and standard deviation values today are believed to be about 0.5 octane numbers. Testing precision has improved and the standard deviation is believed to be about 0.4 octane numbers, it is stated. "However, for the future it would be desirable to have a knock test method with a standard deviation value of only 0.1 octane number." The effects of the greater blending precision and the greater precision in testing over the years, on the refiner's gasoline manufacturing costs, are shown in the accompanying table.

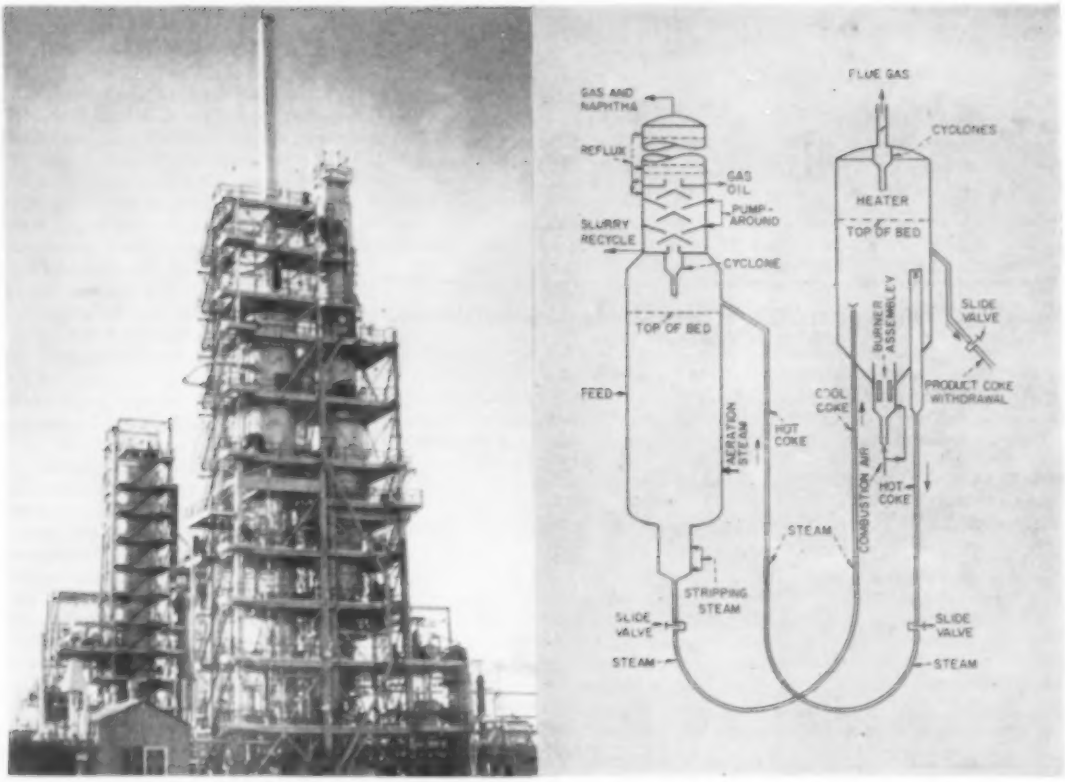
Case I and II represent early operations. In Case I a cost of $26 per 1000 bbls., in assumed but reasonable values, is indicated for product reblending, testing and overproducing on antiknock quality. "To reduce to 5% the 25% of material below specification accepted by test requires an increase in average quality," it is stated, and this results in an increase in cost to $61 per 1000 bbls. as shown for Case II."

The high costs and complaints involved in these cases, it is assumed, provided the incentives for improvements. In Case III costs are reduced to $47 per 1000 bbls. by reducing the standard deviation in testing from 0.8 to 0.4 octane number. In Case IV costs are further reduced to $31 by the reduction in the deviation in blending from 1.0 to 0.5 octane numbers.

"Case IV represents the approximate general situation in the U. S. today," the paper states. "The $31 per 1000 bbls. product costs represent an overall cost of $28,000,000 per year, based on 2,500,000 bbls. of gasoline per day produced in the U. S. These costs — for reblending, testing and product-quality giveaway—are made necessary only because of blending and testing errors.

"Further reductions in these costs can be realized by improvement in knock test methods. If the future goal of 0.1 octane number standard deviation in testing can be realized, the current costs of $28,000,000 per year (Case IV) could be reduced to $16,000,000 as shown by Case VI. However, half of this $12,000,000 saving can be obtained by multi-testing to reduce the present deviation value from 0.4 to 0.2 octane number, as shown in Case V.

"The remaining $6,000,000 saving per year represented by Case VI over Case V applies directly to work aimed at improving knock testing to a standard deviation level of 0.1 octane. Actually, the credits will be even larger because knock testing errors in the testing of components enter in blending deviation values, as employed in this study. Some additional savings would result from the improvement in overall standard deviation in blending values."



USEFUL PROCESS TOOL, this first commercial-scale Fluid coker gives Carter wide flexibility in processing

Why Carter Likes Its Coker

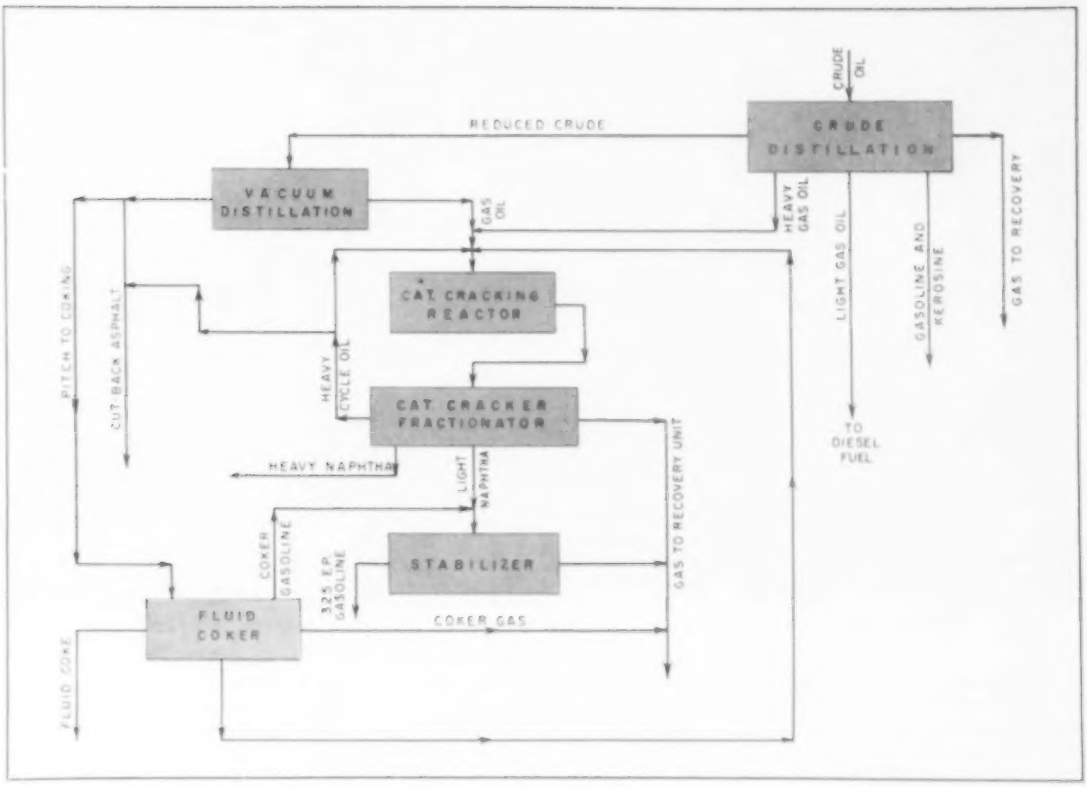
THE first commercial-scale 3,800 b/sd Fluid coking unit has been successfully placed on-stream at the Billings, Mont., refinery of Carter Oil Co. after a few initial difficulties peculiar only to this particular unit and which are not inherent in the process itself. These early runs have confirmed pilot investigations of the operability of the process and flexibility of the unit. Its performance has been most gratifying to the designers and operators.

The Fluid coking process as demonstrated at Billings is unique in many respects:

- Feed may be any pumpable residuum, including stocks ranging from negative values of API gravity to over 20°; i.e., from asphalt to atmospheric residuals or even heavy crude oil.
- The unit is relatively immune to process upsets, including sudden stoppage or radical changes in volume, and is readily returned to production following temporary interruptions of power.
- Gas oil product is clean, relatively low in heavy metal contaminants.
- Coke product is entirely novel in physical characteristics. The process can completely eliminate residual fuels from refinery product list, giving the refinery a choice depending upon the market for resid.
- Products from this plant are small amounts of C_3 and lighter, suitable for polymerization; coker naphtha of relatively high clear octane rating; wide-range gas oil feed for catalytic cracking without further treatment; and granular coke.

By D. P. THORNTON, Jr., Southwestern Editor

The Carter unit well demonstrates the capability of the Fluid coking process to handle extremely heavy residuum feed stock of rather poor quality as compared to vacuum residua from other crudes available in this country. This is particularly advantageous when there exists little or no



HOW THE NEW COKER FITS into the balance of Carter's process flows, helping to boost final gasoline yields

Its performance in turning low-value resid into motor fuel, fuel oil, and coke—the inside story

profitable market for this material as heavy fuel. Also, the portion of charge converted to coke (gross or net) is relatively smaller than yields that are obtained from conventional coking processes.

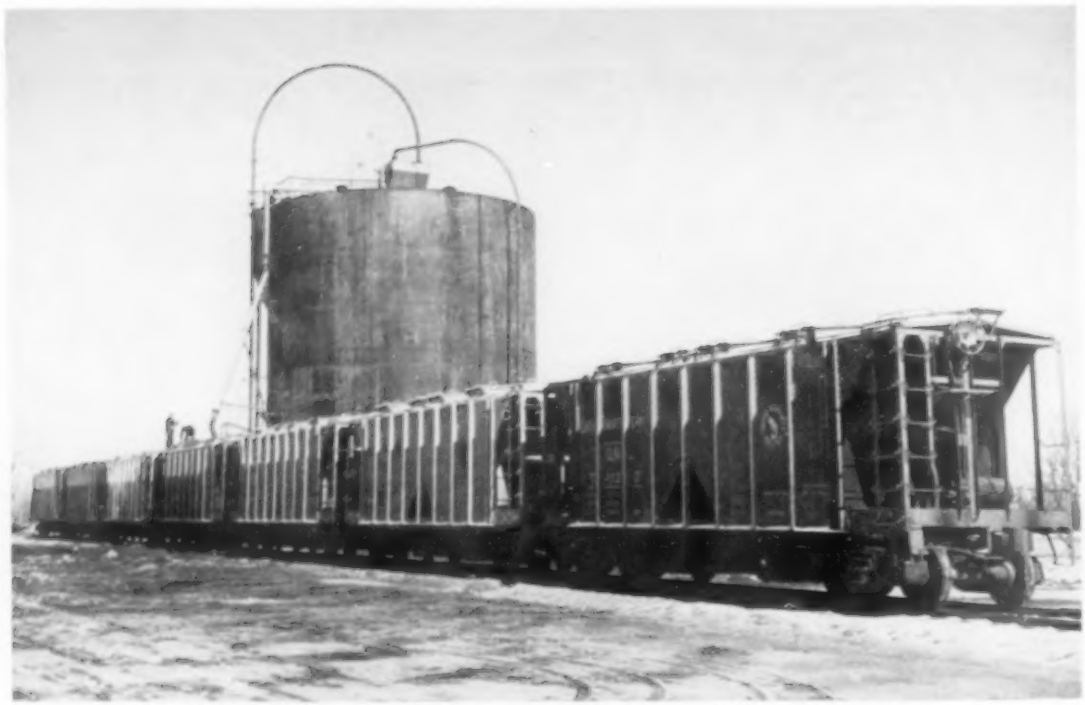
Another important feature in recovering catalytic cracking feed by the Fluid process is that the gas oil is relatively free of heavy metal contaminants which poison cracking catalysts. These materials are decomposed and remain in the coke where, as ash, they can be readily tolerated.

Still another advantage inherent in the Fluid coking process is the elimination of the problems attendant upon heating heavy residual stocks in an

Table 1—How coking changed yields of Billings refinery products

Product	With Coker		Without Coker	
	% on Crude	Volume* b/cd	% on Crude	Volume* b/cd
Motor fuel	47.60	11,900	40.00	10,000
Light fuel oil	26.90	6,725	26.90	6,725
Heavy fuel oil	6.19	1,545	3.10	775
Asphalt & road oil	6.91	1,730	6.91	1,730
Residual fuel	0.00	0	15.00	37.50
Marketable coke	1.44	360**	0.00	0
Products consumed in refining operations (Gas, coke, oil, etc.)	10.95	2,740	8.09	2,020
	99.98	25,000	100.00	25,000

* Based on rated crude charge capacity of 25,000 b/cd
** Equivalent in product bbls.



PRODUCT COKE IS STORED in this former oil tank, transferred pneumatically to hopper cars for shipment

external heater. At Billings, hot pitch from a vacuum distillation unit far below cracking temperature is immediately transferred to the coker reactor, where contact with hot coke quickly brings it to coking temperatures.

Keeping asphalt and road oil production in balance with customers' requirements will be a use for the new coker. The same will be true for heavy fuel oil. All vacuum pitch above these requirements will be coked. When operated at design capacity, refinery gasoline production is expected to increase by 1,500 to 1,800 b/d when the coker is on-stream, while residual fuel will be made only when there are orders booked for it. The coker fits into the refinery scheme as shown in the plant flow diagram, and its effect on products is listed in Table 1. It is operated as part of the crude unit, with the addition of one man per shift to the operating force.

The Carter coker has never been operated at design capacity because sufficient charge stock has not been available since it went into operation. The refinery has been running about 8,000 b/d below rated capacity for the same reason that many others have reduced their runs to stills. The plant has shipped 47 hopper cars of 55 tons each of Fluid coke to customers, plus a large quantity in drums and smaller containers as samples for evaluation, and it still has orders to fill.

The new coker can be operated at any reasonable feed rate. Coke circulation and combustion air rates are merely varied to maintain the desired reactor conditions. If refinery electric power should fail or a steam shortage develop, it already has been demonstrated that the unit can be readily shut down for periods up to at least an hour or so after feed is cut out without undue difficulty getting back on-stream. It is much less sensitive to feed variations, both composition and rate, than catalytic cracking units. There is of course no catalyst in the coker.

Nothing like Fluid coke has been made commercially from petroleum until the Billings unit went on-stream. It greatly resembles microspherical cracking catalyst, although average particle size and density are much greater. Under magnification the particles are seen to be generally spheroidal, possessing small rounded nodules like a raspberry.

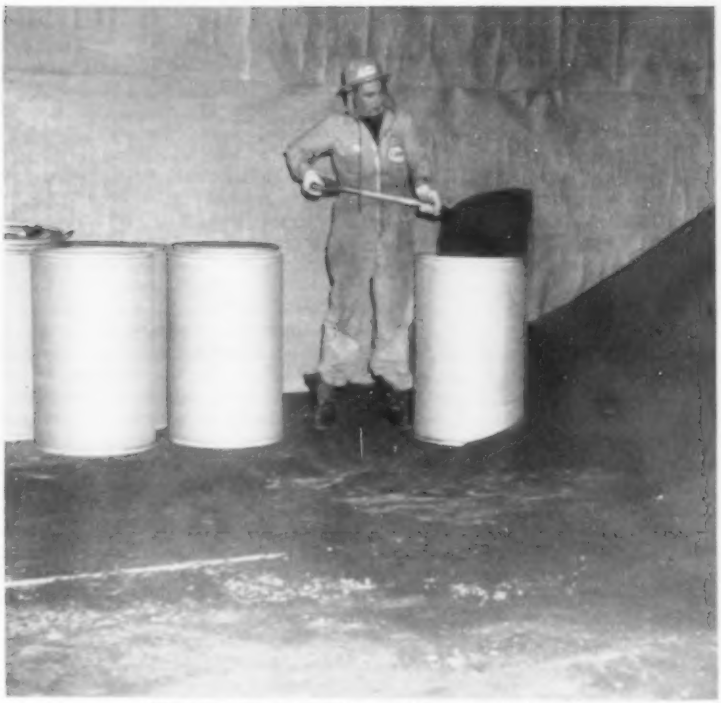
The coke is extremely hard and brittle, contains about 89% fixed carbon and has a high ignition temperature. There is practically no dust. Danger of spontaneous combustion or ignition by static sparks is considered negligible. Burning characteristics resemble those of low-volatile, pulverized anthracite coal. The calorific value is higher for Fluid coke than for anthracite because the ash content is low, approximating that of a good bituminous coal. The coke flows without fluidization and may be handled by conveyor, airslide, pipeline or under fluidized conditions. There are many possible commercial uses for it, including all those for which petroleum coke already is in common use.

The Coker Proper

The Fluid coking unit closely resembles the conventional Fluid catalytic cracking unit as would be expected, but there are some important differences, as indicated in the schematic drawing.

Feed enters the vessel in multiple nozzles which spray the liquid pitch into the fluidized coke bed. This is the first important variation from the Fluid cracking unit. In the latter, the oil to be cracked is injected into the catalyst as it moves into the reactor becoming vaporized by the heated catalyst and aiding in fluidization. The feed plays a minor part in fluidizing the bed in the coker. Fluidization is obtained to some extent, incidentally, by injecting stripping steam at the bottom of the reactor.

Reactor temperature is maintained by the temperature of the hot coke



LIKE DUST BUT NOT DUSTY, coke is handled easily, presents no static or sparking problems

entering the vessel, and by rate of coke flow. Maximum temperature spread within the bed ranges from 2 to 5° F. Pressure is a matter of mere convenience, preferably held above atmospheric. Flow is maintained by conventional pneumatically-operated slide valves positioned by flow controllers in the control room. There is one each on the hot and "cold" coke lines; a third is located on the coke withdrawal line. Reaction temperature may range from 950 to 1025° F., with pitch inlet temperature of 600-650° F. Operating reactor pressure at Billings ranges from 10.6 to 11.7 psig.

Atop the reactor is a small fractionator column through which vapors from the cyclone separator are for the most part condensed. Because the vapors still contain some entrained coke fines after passing the cyclone, this vessel consists of a lower, scrubber section, and an upper, fractionating section. Trays in the scrubber section are the disc-and-doughnut type, over which gas oil reflux is supplied in addition to two pumparound streams of high-boiling gas oil. A scrubber bottoms stream is recycled to the reactor. This recycle may be returned via the fresh feed line, fed separately, or transferred to the vacuum still for eventual return to the coker with the pitch.

The fractionator section is not intended to make a sharp separation between gas oil and naphtha. It contains four bubble-cap trays. The reflux is gas oil, externally cooled with water and returned to the column as a pump-around stream (a second gas oil stream goes to the scrubber). The bottom side-stream product is gas oil of 430 to 1000° F. boiling range and used as part of cat cracking feed.

Overhead product is gas and coker naphtha vapors which, at Billings, are partially condensed at the catalytic cracking unit, the gas going to vapor recovery and the naphtha included as part of the feed to the cat cracker main fractionator.

The fractionator is located atop the reactor to minimize pipe runs for the reactor outlet and slurry recycle stream. It does lengthen the over-all assembly, however. The slurry recycle stream is about the nearest thing to coke which will still pour (—8° API gravity), but fortunately it has a low viscosity index. Long pipe runs for this material must be steam-jacketed if it is to be pumpable in Billings' rigorous winter climate.

Because of the location of the scrubber, accurate level controls, together with appropriate high-level alarms, are provided to prevent spillover of slurry into the reactor outlet.

The heater is quite similar to the regenerator of a conventional Fluid cracking unit and, like it, burns coke. The temperature may range from 1050 to 1150° F. as needed for heat balance. Maximum limiting temperature is dictated by construction materials, however, since protecting a catalyst from overheating is not involved. Temperature differential, bottom to top of bed, ranges from zero to 1° F.

Coke enters the heater through a conventional riser to which steam is admitted via jets at several points to maintain fluidization. Air up to 9000 SCFM is admitted to the auxiliary burner at the bottom of the vessel. The burner is a conventional Peabody unit and is fired with gas to start the unit, after which it admits primary air to fluidize and burn the coke. Secondary air is admitted around the outside of the burner proper. (The burner could be located outside the shell of the heater if desired.) Hot coke leaves the heater for return to the reactor through the conventional standpipe arrangement and again is helped along by aeration. A slide valve is used to control flow.

Product Handling

Coke make withdrawal is from a point near the top of the normal bed level. This line, controlled also by a slide-valve, terminates in a quench drum. Water is sprayed into the bottom of this drum, where it flashes to

steam and cools the coke to around 300-400° F. as it drops into a short standpipe line.

Coke is entrained with air upon entering the transfer line at the bottom of the quench drum outlet standpipe, and blown to a conventional 10,000-bbl. oil tank, 48 ft. high by 40 ft. diameter, and capable of holding 1800 tons of Fluid coke. At present, this is the only major storage facility at Billings.

Coke enters at the center of the tank and is withdrawn from a pipe at the bottom, also centered. This prevents unbalancing the load, because the coke will cone at an angle of approximately 30°, the angle of repose. The air used to transport the coke is vented from near the side of the tank at the top, passing a small filter en route which knocks back any entrained coke.

Aeration manifolds are provided near the bottom of the tank to allow complete emptying. A pneumatic system ending in a rubber nozzle to which is attached a short cylinder of burlap is used to drop the coke into hopper cars for rail shipment.

The pneumatic system connecting the storage tank with the coker is reversed when it is desired to load coke into the unit. In this case, the withdrawal line is connected by a by-pass to the pneumatic transfer line, and the line leading to the top of the storage tank is closed. At Billings, the transfer line is about 1200 ft. long.

Alternatively, coke can be dropped from the unit into trucks for movement to a nearby warehouse in event other storage is full. Fluid coke can be picked up by clamshells providing it first is wetted down to form a "mud."

Steam and flue gas vapors are vented from the top of the heater through two-stage cyclone separators into a tall stack. Back-pressure on the heater is controlled by a conventional variable-orifice as on a Fluid cracking unit. Operating pressure ranges from 12 to 15 psig. (at Billings 12.4-13.2 psig.) and is dictated principally by pressure drop in the system; values are not critical. Higher pressure also permits smaller heater size.

The fluidized bed in the heater is relatively shallow, as the ratio of diameters of reactor and heater indicate. Coke is withdrawn from the system at a sufficient rate to maintain desired bed levels in both vessels. Design coke burning rate is 3325 lbs./hr.

Coke "Seeding"

It is necessary to provide continually a relatively small quantity of coke "seeds." Otherwise, coke particle size would continue to increase by normal growth until the average size became too large for adquate fluidization. In turn, this implies the possibility of control of average coke particle size to meet special customer requirements without screening.

Hence, part of the product coke is ground by a simple device integral with the unit in order to produce seed coke which is returned to the circulating coke system. Since the seed coke is appreciably smaller in average diameter than the circulating coke, the tonnage of seeds required is relatively small.

Coke for start-up is introduced into the heater by the same line used to move coke to storage. However, the standpipe line from the bottom of the quench drum is closed off at this time and a separate vertical line is used to lift coke into the heater.

Start-up procedure is very similar to that for a Fluid cracking unit, in that hot flue gas is circulated through both vessels (empty) until wall temperature of 350-400° F. is reached. Coke then is charged to the heater and firing is continued until the coke temperature reaches 500 to 600° F., when primary air is admitted and fuel gas or torch oil pinched off as coke combustion takes over.

When coke in the reactor reaches the desired temperature, feed is admitted. As soon as there is sufficient coke loaded in to commence circulation into the reactor, gas oil flow is established in the fractionator's scrubbing section to prevent fines accumulation.

Operating Experience

Few problems and delays—most of them expected—were encountered during the initial start-up. Such problems are nearly always inevitable in the transition from the pilot plant to full-scale unit, and Carter's experiences are no exception. Some of these were doubtless responsible for rumors circulating in the industry and generally to the effect that the unit was not operable without extensive design changes and considerable reconstruction.

It is very true that the initial run with oil in the unit lasted only a week and design changes followed as a result of these experiences. But the circumstances which caused this shutdown are extraordinary and should never again face the operator of a Fluid coker.

The cause of the trouble was that the unit, perforce, was started with a material it was never designed to handle: ground coal coke having a reported fines content of 20 to 25% through 200 mesh. This coke breeze is sharp-edged and has the provoking tendency to "hang up" and pack; the angle of repose is about double that of Fluid coke. There just was no available supply of Fluid coke. Another source of trouble was improper aeration (steam) in the stripping section of the reactor.

Initial circulation of coke breeze was difficult to obtain, operators say, due to this "hanging and packing" tendency. Consequently, 12 days elapsed before pitch was admitted to the unit (on Christmas Day). During this time the operators had to learn how to run the unit, instruments had to be adjusted, and the proper position determined for manually operated controls. Coke at times packed in standpipes and had to be "blasted loose" with steam. Regardless, oil was put in to see what would happen. Under the circumstances, the unit operated surprisingly well and began to produce oil products and Fluid coke, about 40 tons being recovered before the unit was shut down.

The coker was down for cleanup and design changes approximately four weeks. Duplicate suction and discharge nozzles were installed in the slurry recycle and scrubber pump around circuits. There was some rearrangement of instrumentation, also.

An interesting point found during inspection was that there was no coke adhering to any of the vessel walls. In the slurry recycle and pumparound lines and the scrubber section of the fractionator some granular coke accumulated. The rest of the system was "clean as a whistle."

The unit was started again Jan. 29. All the Fluid coke made previously was reloaded and the remaining requirement made up with coke breeze. Circulation was established and maintained much more easily than in the initial start-up and the unit heated readily. Pitch was readmitted Feb. 3 and product coke withdrawals commenced Feb. 4.

The unit ran smoothly until April 6, when it was shutdown to permit the refinery to accumulate asphalt products so as to carry through the scheduled turnaround of the crude unit. During the time the coker was down, it was readied for operation before crude unit turnaround time. Because the coker supplies its own heat, it can be operated even though the crude still is down, since feed can be drawn from a supply of cut-back pitch in tankage used formerly for storing residual fuel.

Through the period of Feb. 3 to April 6, various operating techniques were developed and the unit's behavior studied as the pitch feed rate was

Table 2—What coker feed is like: inspection of Elk Basin vacuum residuum

Gravity, °API	2
Penetration @ 77°F.	10
Pour point, °F.	120+
Sulfur, wt.-%	3.8
Conradson carbon, wt.-%	30.0
Carbon, wt.%	86.4
Hydrogen, wt.-%	9.8
H/C, atomic ratio	1.35

gradually increased to the maximum rates permitted by available feed stock. The highest fresh feed rate to date has been 3,090 b/sd. Recycle rates have varied up to a maximum of 1,410 b/sd. Maximum total feed was 3,980 b/sd, compared with design of 5,100 b/sd. Initially, also the recycle was pumped to the vacuum unit rather than returned directly to the coker to permit concentrating attention on primary operations. Later, recycle was injected into the reactor with no unexpected effect on operation.

Yield tests were commenced March 20 and continued until the unit was shut down. The data are still being worked up.

Now that there are ample supplies of Fluid coke available, the circulation and plugging difficulties which the Carter refinery experienced are matters of interesting history. Fluid coking units which now have been authorized will start on Fluid coke from Billings, or from the unit soon to be completed at Baltimore (Esso Standard).

It was notable, according to the Carter operators, that as soon as the sharp edges of start-up coke became covered over with petroleum coke, there were no more circulation difficulties. What problems have resulted since have been for the most part due to experiments with the unit to determine its behavior under various conditions and an occasional "blooper" by the operators themselves in making adjustments for these experiments.

Upsets No Problem

Illustrating the difference in performance, now that experience and a Fluid coke inventory have been built up, and also the unit's flexibility and insensitivity to upsets, is the history of an inadvertent near-shutdown caused by failure of commercial power.

The outage lasted approximately 30 minutes, at a time when all plant units were on-stream. Switchover to steam was made immediately and, in order to provide as much steam as possible for the other units, the coker feed was dropped out and the air to the heater greatly reduced, in order to throttle down the steam-driven air compressor (at low speeds, these units tend to "hog" steam). It was very difficult under these conditions to keep coke circulating, even after a fashion, and finally even this was lost for a time. Yet, the coker was never brought completely down.

When the power outage was over and most of the rest of the refinery back on normal electric drive, steam was restored to the coker air compressor and normal circulation quickly reestablished. Feed was gradually restored to the unit, and within an hour after power was on, the coker returned to normal operation. Coke withdrawals did not commence again until much later, however, because considerable coke was consumed in maintaining temperature during the period when there was no feed to the unit.

Incidentally, a much longer time than an hour was required to get the plant's Fluid catalytic cracker settled down again.

Few Changes Planned

There are still a relatively few, minor modifications to be worked out when the next shutdown comes, during which the coker will also be carefully inspected again. It is not yet known, for instance, when shutdowns should be scheduled. Notable among the changes will be strengthening and increasing the number of structural members supporting the unit to make the structure more rigid. About 20 ft will be cut off the stack: it is unnecessarily long.

At present, the fractionator atop the reactor is virtually unsupported by structural members on one side and the stack on the heater projects far above the rest of the unit, which is about the height of an 11-story building. It is believed that more rigid support will counteract the noticeable "sway" of the unit, believed caused by the "fluid" churning around in heater and reactor.

Results Are Good

Fresh feed to the Carter unit is virtually pure asphalt with a penetration at 77° F. ranging from 0 to 10 and API gravity ranging from 0 to 2. The slurry recycle has a gravity as low as —8. These materials are much heavier than are normally charged to other types of coking units. The Fluid coker is not limited to these very heavy materials, since residua as light as 15° API have been run in the pilot unit without difficulty, although they have not been tried commercially on the Billings unit. An inspection of a typical pitch charge is given in Table 2.

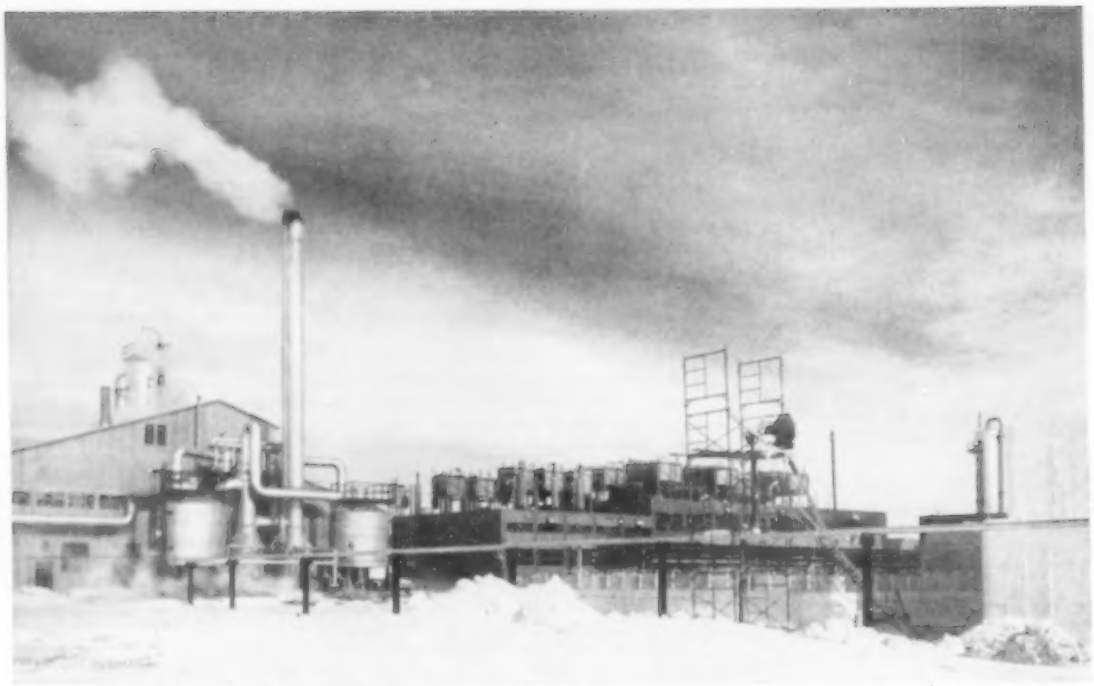
Table 3—Pilot results were close to full-scale on Fluid coking of the Elk Basin vacuum residuum feed

	Pilot Unit	Full scale Carter unit
Volatile matter, wt.-%:		
at 1100° F.	1.3	0.4
at 1742°F (950°C)	5.3	3.8
Carbon, wt.-%	88.6	89.1
Hydrogen, wt.-%	1.8	2.1
Sulfur, wt.-%	6.4	6.1
Ash, wt.-%	0.370	0.1
Ash components, wt.-%:		
Nickel	0.011	0.01
Vanadium	0.035	0.03
Iron	0.003	<0.01
Screen analysis, %:		
retained on 48-mesh	0-5	5
retained on 100-mesh	40-80	75
through on 200-mesh	below 10	8.0
Heating value, Btu/lb. as rec'd.	14,000	14,000
Particle density, gm./ml.	1.5	1.5
Bulk density, lb./cu.ft.	60	60

Inspection of the coke in Table 3 indicates somewhat better quality than predicted in the pilot plant. The ash content of 0.1% is considerably lower than expected, particularly since the heavy metals in overhead products are lower than in conventional coking. The carbon content of 89% is the same as indicated in pilot studies. There is slightly less volatile matter. The sulfur is high, as expected, because Elk Basin crude is sour and the pitch feed contains 4% sulfur.

Carter now is engaged in developing markets for the Fluid coke. As it now stands, the untreated coke probably will not be acceptable for use in making electrodes for aluminum, steel and magnesium production because of its excessive sulfur, unless the coke is processed further for sulfur removal. This is a peculiarity of Elk Basin crude, however, and will not be a factor with pitches from more sweet crudes.

A large cement plant on the West Coast and a large electric power plant on the East Coast have ordered large quantities of the Fluid coke for burning tests in their conventional equipment. In addition, numerous potential customers have ordered smaller quantities for investigation. Fuel applications probably will be the largest volume users, either as-received, or, possibly, in briquets of various shapes for stoker-fed equipment. It is too early to say, however, what the ultimate applications of this unique material will prove to be.



TOUGH CONDITIONS FOR NATURAL GASOLINE manufacture, a problem Signal Oil & Gas faced in its new Tioga plant

Frigid Weather No Obstacle

How Signal Oil operates on a 'dry' basis to beat the freezing climate in North Dakota

TODAY cold climate natural gasoline plants are few.

But tomorrow may well be a different story.

With greater activity in crude oil and natural gas production in the northern states and in western Canadian provinces, chances for more processing have increased.

Though still on a small scale, natural gasoline processing in five of the colder states has grown far faster than the rest of the nation just in the past year. Taking Colorado, Montana, North Dakota, Utah, and Wyoming as the typical cold weather area; the number of plants rose from 13 to 17 from 1954 to 1955, a 30.8% boost. This compares to a 7.2% increase in the number of plants throughout the U. S. in the same period.

Gasoline production jumped 20% for the same area as against 2% rise for the entire country, and natural gas throughput went up 17% as compared to 10%.

If you're among those looking favorably at cold climate locations—or if you run into some of the rugged weather conditions even the southern regions have—it may pay to see what Signal Oil & Gas Co. has done at its new Tioga, N. Dak., plant, onstream in November, 1954. Capable of handling 65 MM cfd of gas, producing 25,000 gal./day of natural gasoline and 110,000 gal./day of butane and lighter, it is the first natural gasoline plant in the state.

The kind of problems Signal faced and what they did about them was brought out by J. B. Taylor of Signal in his paper at the 34th annual meeting of the Natural Gasoline Ass'n. of America, April 13-15, in Dallas, Texas.

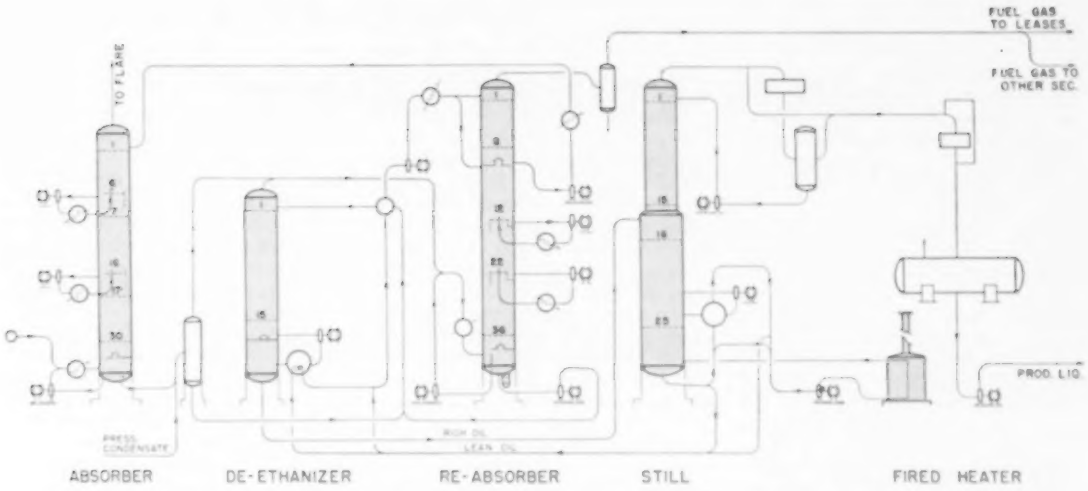
Temperature extremes ran from 30 below to 100 above in this location, which is some 40 miles south of the Saskatchewan border, 70 miles east of Montana, and 50 miles east of Williston. Yearly average temperature is 40, and for five months of the year the average is below 30.

Designing for operation under freezing conditions, Signal decided to dehydrate the gas before absorption. This meant the absorption plant could be operated free of freezing materials, or water, and as a result:

1—Pumps and tower bases did not have to be housed for protection against the hazards of "freeze-ups."

2—Lines did not have to be steam-traced and insulated because they would carry no water or water vapor.

3—Temperatures of condensers and the like could be permitted to fall below freezing.



WIDE USE OF AIR-COOLED HEAT EXCHANGE features process flow at the Tioga natural gasoline plant

4—Shutdowns could be made without danger of freeze-ups.

Besides low temperatures, frequent storms and blizzards at Tioga reduce visibility to virtually zero. This meant placing indicating and recording instruments in the control house in addition to the actual controllers and other units normally installed indoors.

A second problem and one which the weather helped solve was the lack of sufficient water for adequate cooling. Water wells drilled in the area have small capacity and the water requires treatment. Because of this, aerial units are used in all services for cooling and condensing. Water usage has been restricted to only such periods as required to maintain reasonable operations during the warmest air conditions.

Weather also affected the content of the wet gas available to the Tioga plant. Since the temperature extremes at the lease separators affect this value materially, the richness varies considerably over a twelve-month period. The high propane content, as shown in the table of analyses, made it economical to consider a high percentage extraction of propane. And also because the area is one of low temperatures, the market demand was expected to make it desirable to design for a 90% recovery of the propane.

Flow through the plant is illustrated in the schematic diagram. To operate at 90% recovery of the available propane, large volumes of ethane and methane were also absorbed at 750 psig. About 12% of the wet gas entering the absorber was found dissolved in the rich oil. Thus, approximately 7,000,000 cfd of ethane and methane is discarded in the de-ethanization of the rich oil from the top of the re-absorber for plant fuel use.

With air-cooled condensing, the degree of de-ethanization is important during the warmest weather. Inclusion of much ethane in the raw product accumulator would make total condensing difficult when the temperature of the atmosphere was above 90° F. This also precludes using vapors or gases for stripping in the distillation unit.

Absorption Plant

Design conditions for Tioga are based on 65 MMcfd of field gas being raised to 750 psig. for absorption. Gas is purified of H_2S and CO_2 at the first stage discharge and dehydrated at the third stage discharge, before absorption.

Shrinkage through these units, removal of acid gases and condensables, reduces the amount of wet gas to the 750 psig. absorber to approximately 58 MMcf. In order to extract a high ratio of propane and heavier, it was desirable to keep the temperature rise through the absorber at a minimum. For this reason, the wet gas to the absorber is commingled with oil from the bottom tray and passed through an aerial cooler to remove the heat of absorption of the heavy ends.

During summer temperatures, the

High Propane Recovery was economical at Tioga

	Gas Analysis			
Separator Temperature:	**Summer 80° F**		**Winter 30° F**	
Component	**Mol %**	**GPM**	**Mol %**	**GPM**
Carbon Dioxide	1.259		1.347	
Nitrogen	1.399		1.496	
Hydrogen Sulfide	2.883		2.962	
Methane	57.577		61.387	
Ethane	16.690		17.311	
Propane	10.405	2.846	9.895	2.707
Iso-Butane	1.658	.539	1.292	.420
Normal Butane	4.060	1.271	2.838	.890
Iso-Pentane	1.213	.441	.587	.213
Normal Pentane	1.038	.374	.446	.161
Hexanes	1.282	.524	.337	.138
Heptanes Plus	.536	.268	.102	.051
Totals	100.000	6.265	100.000	4.580
Propane at 90%		2.561		2.436
Excess Butanes		.947		1.007
26# Gasoline		2.472		.866
Total		5.980		4.309

lean oil circulation approximates 375 gpm. Under this condition, the so-called "equilibrium tray" at the bottom of the absorber accounts for 4,900,000 Btu/hr. in absorbing the heavy hydrocarbons. The combined material is returned to the base of the absorber where the gas is separated to continue through the trays to the top of the absorber.

There are also two intercoolers in the absorber flow design—one below the 6th tray and the second below the 16th tray—for removing heat of absorption from the contacting oil stream. The upper intercooler is expected to remove approximately 755,000 Btu/hr. and the lower intercooler, 930,000 Btu/hr. The removal of this amount of heat during the absorption process makes it possible to maintain maximum absorption capacity with a minimum of oil circulation. Also, effective column capacity is not reduced by internal reflux conditions.

The rich oil from the base of the absorber is further enriched by adding the pressure condensate which has been dehydrated. This rich oil stream is then "flashed" at 300 psig. in the rich oil flash tank.

Rich Oil Rectification

The rich oil rectification is accomplished in two tower sections, one a deethanizer column and the other the reabsorber section. The deethanizer section consists of 20 trays. The rich oil feed to this column includes the rich oil from the high pressure flash tank and the rich oil stream from the base of the reabsorber. This combined oil stream is preheated by exchange with lean oil before entering the top of the deethanizing column.

Oil arriving at the base of the deethanizing column is picked up by circulating pumps which pump the oil from the base of the column through heat exchange, or reboiler, against the hot lean oil from the still.

The oil and flashed vapors are returned to the base of the column where the vapors rise through the 20 trays against the down-flowing rich oil, to the top of the column. The heat transfer in the reboiling section is designed for 42,000,000 Btu/hr.

The vapor stream from the top of the deethanizing column is joined with the vapors from the rich oil flash tank. This combined vapor stream is then joined with the rich oil from the bottom tray (33rd) of the reabsorber. This stream then passes through an aerial cooler or "equilibrium tray" similar to the bottom cooler on the absorber to remove the heat of absorption. It is then returned to the bottom of the reabsorber where the resulting gas and vapors are separated to flow up the reabsorber column. The heat of absorption at the base of the reabsorber approximates 1,500,000 Btu/hr.

The rich oil leaving the reabsorber is pumped in with the rich oil from the rich oil flash tank to the top of the deethanizer column. As mentioned previously, this oil is heated through exchange with the lean oil before entering the top of the deethanizing column. The preheating of this rich oil removes some 12,500,000 Btu/hr. from the lean oil.

The combination of these two columns is designed to be able to remove ethane and lighter hydrocarbons from the rich oil stream, and to retain all of the propane and heavier hydrocarbons. The propane that leaves in the vapor stream from the deethanizing column is in turn recovered in the reabsorber section and returns with the refluxing oil. A single column operation has actually been divided into two columns.

Sufficient of the lean oil stream is put over the reabsorber to prevent economically loss of propane in the resulting vapor leaving the reabsorber section.

To make this reabsorber an efficient column there are also provided intercoolers for removing the heat of absorption at the 13th and the 23rd trays. The heat removal here is about 1,100,000 Btu/hr. at each cooling unit.

These are actually 7 and 17 trays, respectively, from the top of the reabsorber section. The top 6 trays are a presaturating section for the lean oil that is used in the main absorber. At the presaturator, the heat of absorption of methane and ethane, which is approximately 2,000,000 Btu/hr., is removed from the oil before it enters the main absorber. Also, this absorbed quantity of dry gas is carried to the 750 psig. stage and in consequence reduces the amount of gas that is necessary to be used at the 250 psig. pressure level.

Distillation

Rich oil from the base of the deethanizer column goes directly to the feed tray of the still, which is the 16th tray. Since there is a reduction of pressure here from approximately 250 psig. (deethanizer) to 100 psig. on the still, there is some flash at this feed tray.

The down-flowing oil is removed after the 21st tray and circulated through heat exchange transferring 33,000,000 Btu/hr. with lean oil from the bottom of the still, to provide a controlled temperature gradient at this point of the column.

With a "dry" distillation, still performance is dependent upon the introduction of sufficient heat to remove all gasoline fractions from the oil and to carry them overhead in vapor form, in the same manner as a fractionation column. Heat is introduced at the bottom of the still by circulating the oil from the bottom tray through fired heaters. In order to maintain a low temperature rise of the oil, about 3 gallons of oil are circulated to the furnace for each gallon of actual lean oil circulation used in the main absorber and reabsorber.

This high circulation makes it possible to introduce a high Btu quantity, partly of latent heat at lower outlet temperatures than would result if the same amount of heat at lower circulation rates were to be used.

Total heat load requirements for distillation from the fired heaters is 50,000,000 Btu/hr. An additional 25,000,000 Btu/hr. fired heater is provided for heat requirements in the fractionating section of the plant and other plant heating loads. Hot oil circulation is used to avoid the use of steam.

Since the maximum still loading is encountered during summer periods when the gas is richest with heavy hydrocarbon content, the still design was based on this condition.

As a result, future expansion of distillation capacity may be obtained by removing the pressure condensates from the oil stream. This would reduce the hydrocarbon content of the rich oil to the amount of hydrocarbons in the gas entering the absorber only. By stabilizing the pressure condensates separately, the distillation unit is relieved of handling this hydrocarbon content. By removing the pressure condensates and treating them in this manner, the still is able to handle the equivalent hydrocarbon content by treating additional wet gas volumes.

Control of the end point of the hydrocarbon product is made by refluxing back heavy gasoline fractions from the primary condensers. The unit operates totally condensing.

Stabilizing or separation of the final products is straightforward. Propane is produced overhead from the first column, with all butane and heavier as feed to the second column, where butanes are removed overhead and natural gasoline is produced as a kettle product. The heat load, as mentioned previously, is supplied by a hot oil circulation from a fired heater.

Design and engineering of the Tioga plant was handled by J. F. Pritchard and Company, Kansas City, Mo., and construction was by Brown & Root, Houston, Texas.

PART 3—In the series on
"KEEP THOSE PRESSURE VESSELS SAFE"

Pressure Relief Devices

What the Inspector must know to keep them in safe operating condition

By WALTER SAMANS
Consultant on Pressure Vessels

A SAFETY relief device is one which is automatically actuated by excessive system pressures in order to protect both equipment and operating personnel. However, if not properly applied and maintained, the safety relief device may become a source of annoyance, or even a menace.

The only purpose served by "safety relief valves" is to mitigate the consequences of one type of misoperation —the building up of excessive pressures too high for the pressure vessel to withstand safely.

Choosing one valve type over another — whether pop safety valve, safety valve, safety relief valve, or relief valve — depends upon the fluid being handled in the vessel onto which the valve is mounted.

The following presentation is limited to safety valves and relief valves installed for industrial processing plant operations. Mentions of steam boiler safety valves are only to aid the discussion.

Categories discussed will include unfired processing heaters with their connected headers, drums, and reactors, and any containers of fluids held under pressure in storage, either in processing or as stock.

Vacuum vessels are here considered —for inspection purposes—to be in the same class as pressure vessels, although their relief devices (vacuum breakers) are mechanically different than pressure-relief valves.

Pressure pumping equipment, such as turbines, compressors, pumps, and other accessories connected thereto are not considered in this discussion, nor should they be considered in rules written for pressure vessel construction or inspection.

Vessels with exothermic reactions are also excluded from this discussion since this equipment often requires specialized knowledge not required of pressure vessel inspectors.

Effective inspection of the safety relief devices attached to pressure vessels requires that the inspector have a working knowledge of the different types of valve applications and the materials being processed within the pressure vessel.

Safety and Relief Devices

Weighted safety valves of the old type dead-weight or lever-and-weight types are in limited use now due to their heavy weights, long levers, and ease with which the pressure settings can be tampered. Their use is now legislated against by most safety codes.

Pop safety valves are characterized by a sudden opening to full lift that

You'll need to know these terms to understand safety relief devices

ACCUMULATION is the pressure increase which occurs during discharge through the safety or relief valve over its set-pressure in psig.

ACCUMULATED PRESSURE (RATED FLOW) is the pressure in the vessel when the rated flow through the relieving device or devices is attained. Generally, the maximum is 110% of the maximum allowable working pressure of the vessel for vapor service under all cases except fire exposure for which 120% is allowed. For liquid service the maximum accumulated pressure is 150% of the maximum allowable working pressure, but may be lower in some codes for unfired pressure vessels.

BACK-PRESSURE is the pressure developed on the discharge side of the safety or relief valve.

LIFT is the rise of the disk in a safety or relief valve.

MAXIMUM ALLOWABLE WORKING PRESSURE is defined in the construction codes for unfired pressure vessels and depends on the material of construction, its thickness, and the basic design service conditions. The vessel may not be operated above the maximum allowable working pressure at the design metal temperature—or the equivalent pressure for any other metal temperature. Consequently, for any operating metal temperature contemplated, the maximum allowable working pressure is the highest pressure at which the primary safety or relief valve may be set to open.

OPERATING PRESSURE of a vessel is the pressure, in lbs./sq. in. gage, to which a vessel is usually subjected in service. A processing vessel is usually designed for a maximum allowable working pressure in psig which will provide a margin of 10% or 25 psi—whichever is greater—above the operating pressure. This margin prevents premature operation of the relief device due to minor pressure fluctuations during normal operation.

OVER-PRESSURE is any pressure over the maximum allowable working pressure of the vessel.

SET-PRESSURE is the valve inlet pressure in psig at which the safety or relief valve is adjusted to open.

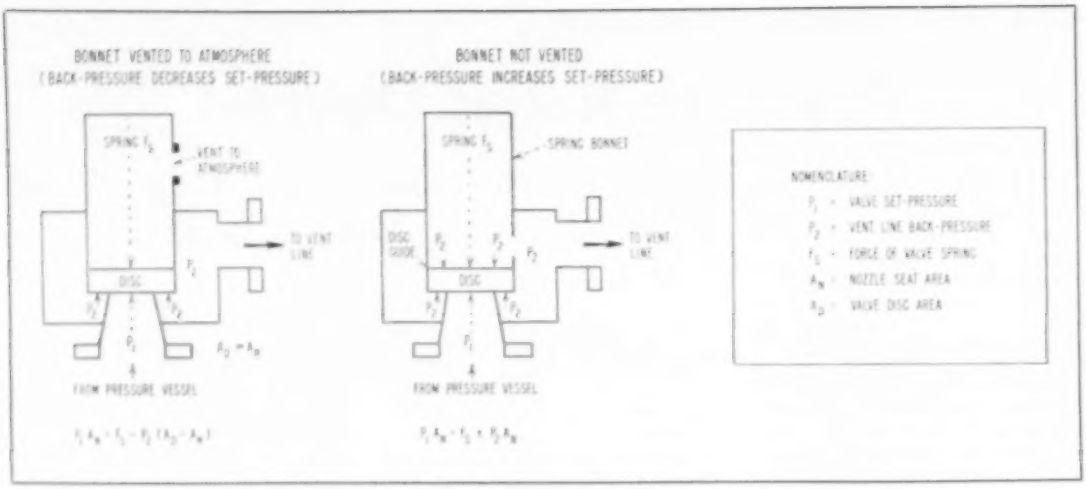
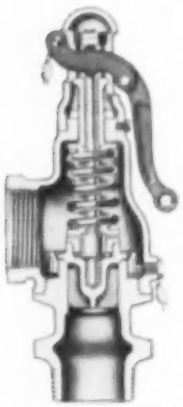


Fig. 1—**Back-pressure affects** conventional safety valve set pressures



(Courtesy Crane Co.)

Fig. 3—**Disc seats can be cleaned** in operation on pop-action valves with disc-lifting levers

will be maintained until the set blow-down pressure is reached and the valve closes. Their design is predicated on their use for a compressible—therefore expansible—fluid acting through the seat opening (or primary orifice) against secondary surfaces in the valve to provide added lifting power to the disc, thus causing the valve suddenly to "pop" open.

Figs. 1 and 2 illustrate schematically the operation of typical unbalanced (vent line back-pressure affects valve set-pressure) and balanced (vent line back-pressure has little effect on valve set-pressure) pop action safety valves, and Fig. 3 illustrates a pop action valve with a disc lifting lever. Fig. 4 illustrates the typical effects of vent line back-pressure on the operation of unbalanced pop-action safety valves.

Adjustment for the desired popping action is obtained by adjusting the blow-back regulating ring which adjusts the secondary orifice area in the valve as shown on the huddling chamber in Fig. 5.

Relief valves do not have a pop-action, but provide that the valve disc is raised from the seat in proportion to the pressure increase above that at which it operates. Relief valves are primarily used on liquid service and when the vessel is apt to become filled with liquid.

Liquid relief valves are seldom large, and are often permitted to have their spring setting as high as 50% above the designed working pressure of the vessel they relieve. Liquid relief valves reach their rated capacity at about 25% accumulation.

A typical simple poppet type relief valve—without auxiliary disc lifting means—is illustrated in Fig. 6. This valve responds to the rise and fall of pressure in a manner as gentle or rapid as the rate of pressure change in the system.

No blow-back regulating ring is provided for these simple relief type of valves, as the creation of a secondary orifice would tend to induce chattering in this type of valve.

Safety-relief valves are primarily designed for gas or vapor service, and are constructed on the same basic principle as pop safety valves. Safety-relief valves have blow back regulating rings and are characterized by a pop-action.

For liquid service, the blow-back ring is either removed entirely, or rendered ineffective by screwing it down out of the path of flow. In this case safety-relief valves have no pop-action and become simple relief valves.

Pilot-operated relief valves combine pressure actuation with a temperature control which is set to a predetermined limiting value. These find their main application in processes where there is a time lag between an excessive rise in processing temperatures and the resulting increase in pressure.

The dual function pilot-operated relief valve can be set to admit a cooling spray—or actuate some other temperature control measure—in an attempt to keep the temperature, and consequently the pressure, within safe limits.

Pressure vessel codes provide that where pilot-valve operated control is applied to safety relief valves, the main relief valve will open automatically at not over the set-pressure and discharge at its required relief flow capacity in the event that the pilot valve should fail to operate properly.

Installation of these devices should be in such a manner that the inspector may examine them and ascertain their condition without necessitating a shut-down of the processing operation.

Rupture discs are only permitted to supplement regular types of safety relief valves, except on small vessels which usually are in special transit service, or in some outlying location.

A rupture disc is a thin sheet of metal—sometimes corrugated in concentric convolutions, dished, scored, or flat—placed across an outlet flow line from a pressure vessel and held securely between rings or flanges.

Burst tests of rupture discs make it possible to predict the bursting pressure at any specified service condition within a specified tolerance range.

Other relief devices are available which are not of the spring loaded type, but as these are usually supple-

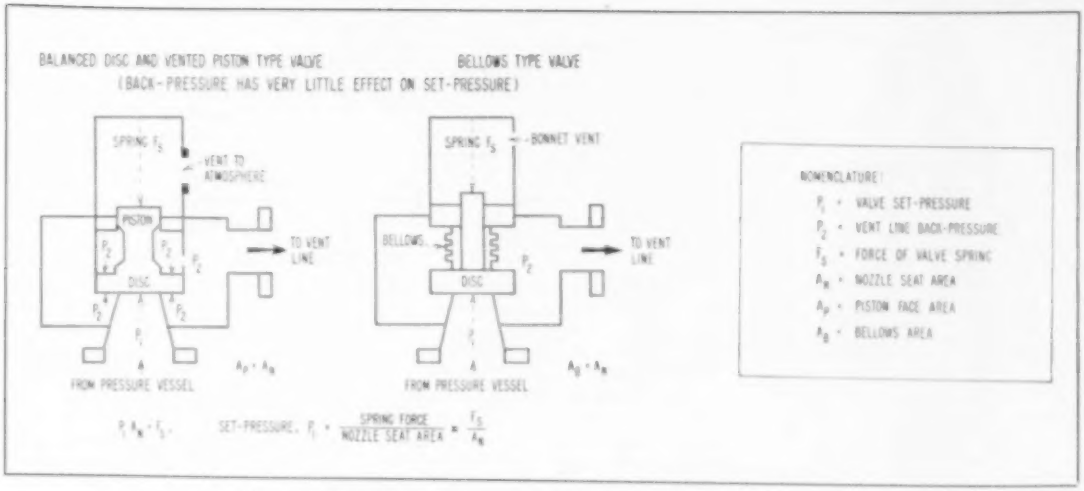


Fig. 2—**Back-pressure does not affect** balanced safety valve set pressures

mental on important pressure vessel installations, they will not be discussed in this article.

Maintenance and replacement for these other types of safety devices should be under the same conditions of care, prevention and inspection as the spring loaded types.

Relief Flow Capacities

The flow capacity rating for a single valve is given for some percentage of "over-pressure" above the "set-pressure" at which the valve opens.

Safety valve selection should be based on rated discharge capacities, not the pipe size.

Safety valve capacities should be at least equal to the maximum generating capacity or output of the system to which the valve is connected.

ASME and *API-ASME Unfired Pressure Vessel Codes* require that all safety and relief valves shall be tested at 10% over-pressure. For emergency use, when a pressure vessel's location may expose it to accidental exterior fires, supplementary valves may be installed which then may be rated at 20% above the set-pressure. Actually, the difference in flow capacity rating would be very little more except for change in density at the higher over-pressure for a perfect gas or air, because of the characteristic change in saturated vapors that results in increasing their compressibility factors with increased pressure (see Fig. 7).

Actual performance tests are sometimes required if there is any doubt as to whether a valve is large enough. The unit is tested at its maximum flow capacity, and the pressure rise should not exceed values prescribed by the strength of the system, or by the

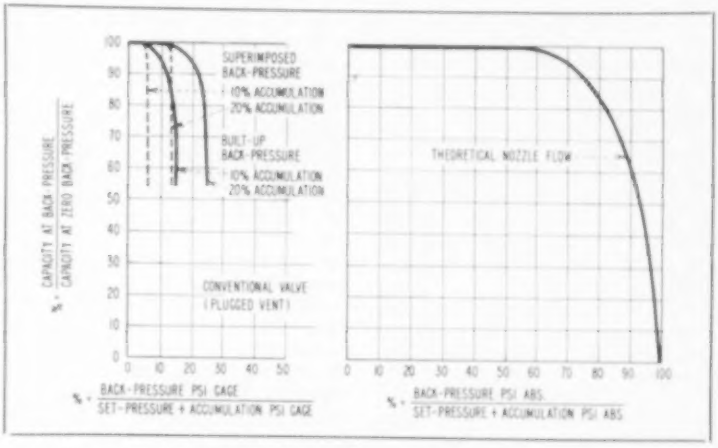
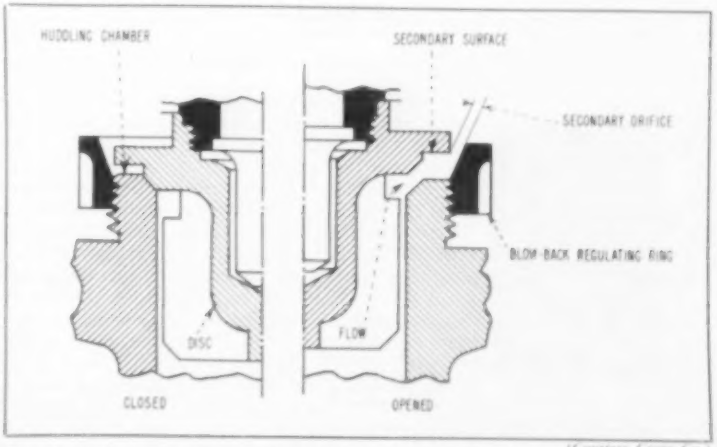
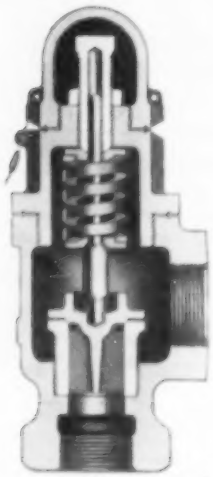

% = CAPACITY AT BACK-PRESSURE / CAPACITY AT ZERO BACK-PRESSURE
SUPERIMPOSED BACK-PRESSURE
10% ACCUMULATION
20% ACCUMULATION
BUILT-UP BACK-PRESSURE
10% ACCUMULATION
20% ACCUMULATION
CONVENTIONAL VALVE (PLUGGED VENT)
% = BACK-PRESSURE PSI GAGE / SET-PRESSURE + ACCUMULATION PSI GAGE
THEORETICAL NOZZLE FLOW
% = BACK-PRESSURE PSI ABS. / SET-PRESSURE + ACCUMULATION PSI ABS.

Fig. 4—**Back-pressure reduces** safety valve discharge flow capacities



(Courtesy Crane Co.)

Fig. 5—**Valve operation is adjusted** from a gradual release to a sudden pop with the huddling chamber blow-back ring



(Courtesy Crane Co.)

Fig. 6—**Liquid relief** by simple poppet type relief valves does not have pop action

ASME and *API-ASME* safety codes.

Valve testing on steam, air, or natural gas is permitted by the 1952 edition of the *ASME Unfired Pressure Vessel Code*. Tested values are marked to indicate the quantity they are capable of discharging in pounds of steam per hour, or cubic feet of air per minute. The Code includes formulae and factors for converting these capacities to other fluids.

With compound vapors, not applicable for steam alone, there are several variables concerned with the changing nature of the outflow after the relief valve opens, making accurate calculations impossible. In these cases estimates alone may be considered acceptable.

Outlet or vent line back-pressure has a direct effect on the discharge capacity of a safety valve, and may cause a material reduction in flow rates in a long discharge line. This will be further discussed in *Part 4* under *Pressure Relieving Systems*.

Safety Valve Installation

Safety valves should always be installed in a vertical position with no restrictions in either inlet or outlet piping.

Flammable or noxious fluids are best handled with valves having a pressure-tight superstructure with a side outlet to permit piping away the discharge.

Stop valves should not be used between the safety valve and the equipment being protected, except under rigid manual control rules during the required abnormal use of such stop valves.

Pop safety or safety relief valves are referred to in the safety codes for units in which vapor is generated, or air or gas is stored, since these valves have high discharge rates, have a positive action, and can be controlled as to their blow-down.

Direct connection to the tank, pressure vessel, or boiler steam drum will give best results from pop safety and safety relief valves. Remote connections through lengths of piping cause pressure drop lags and the possibility that the valves will chatter upon actuation, as well as the tendency for the valves not to discharge at their rated capacities.

Valve chattering will shortly ruin the valve seating faces with possible failure and rupture of the valve or parts.

Side outlet valves should be used in cases where it is desirable to pipe the valve discharge away from the immediate vicinity. The outlet piping should be arranged and supported to remove load and thermal expansion strains through the medium of slip joints. Typical outlet piping recommendations are indicated by Fig. 8.

Safety valve inlet or outlet lines should under no circumstances make a reduction from the nominal size of the valve. Not only will this restrict the discharge rate of the valve, but chattering can result due to the back-pressure created which momentarily adds to the spring load to set the disc against the inlet pressure. Where it is necessary to operate against back-pressure, special valve designs can be obtained.

Relief Valve Tightness

A safety valve is at a distinct disadvantage in respect to leakage. While a gate or globe valve can be forced closed so as to make the valve seats conform to each other, the safety valve relies only on the closely balanced differential between the spring load on top of and pressure load under the disk. Therefore, safety valve seating faces must be exceptionally good.

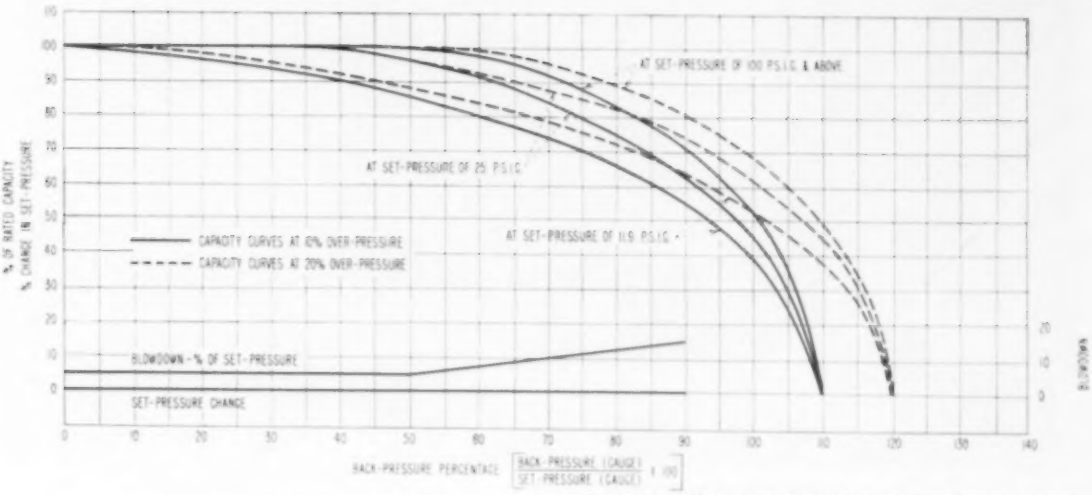
Valve distortion and a resulting disorientation of safety valve seats may result when mounting the valve with a pipe wrench; therefore only open-

Coming Next Month

Safety relief device inspection and the inspector's viewpoint of safety relief lines and systems will appear in the fourth and concluding part of Walter Samans' discussion of inspecting unfired pressure vessels.

Meet the Author

Walter Samans, consultant, was born in Goes, Holland, becoming a U.S. citizen in 1904. Educated in Philadelphia, he received his B.S. in M.E. from the Univ. of Penna. in 1905. Except for the years from 1906 to 1916 when he was Asst. Engineer to the Chief Engineer for the Bessemer & Lake Erie R.R., he was with the Atlantic Refining Co. from graduation until 1937 as Design Engineer, Asst. Chief Engineer, and Chief Engineer. From 1937 until retiring in 1950 he was Mechanical and Administrative Engineer with Sun Oil Co. Mr. Samans has been active in many technical committees of the API since 1926, serving as chairman on several occasions, and has served on several ASME committees since 1932. Starting in 1940, he served on several committees for the Army, Navy, and Defense Departments as member and chairman, and helped to write and edit numerous military handbooks on petroleum fuels, bulk terminal, and storage operations. He was, from 1941 to 1945, a consultant on fuel terminals to the Bureau of Yards and Docks of the U.S. Navy. From 1946 to 1949 he served as the first chairman for the Pressure Vessels Research Committee of the Welding Research Council, a committee he helped to organize. Walter and his wife Katharine have two sons, Carl H. who is Assoc. Director, Engrg. Research for Standard Oil of Ind., and Walter A. who is Field Project Manager for E. I. du Pont de Nemours.


% OF RATED CAPACITY
% CHANGE IN SET-PRESSURE
AT SET-PRESSURE OF 100 P.S.I.G. & ABOVE
AT SET-PRESSURE OF 25 P.S.I.G.
AT SET-PRESSURE OF 10 P.S.I.G.
CAPACITY CURVES AT 10% OVER-PRESSURE
CAPACITY CURVES AT 20% OVER-PRESSURE
BLOWDOWN - % OF SET-PRESSURE
SET-PRESSURE CHANGE
BLOWDOWN
BACK-PRESSURE PERCENTAGE
BACK-PRESSURE (GAUGE) / SET-PRESSURE (GAUGE) x 100

(Courtesy Consolidated Safety Relief Valves, Manning, Maxwell & Moore)

Fig. 7—**Over-pressure settings** have little effect on relief flow capacity at low back-pressures

end wrenches should be used for these.

Excessive tightening of safety valves with their tapered pipe threads, and improperly supported outlet piping are additional causes of valve distortion and leakage.

Lifting Discs

Except for safety valves as usually installed on processing pressure vessels, many safety valves are equipped with levers with which the disc can be manually lifted off its seat. This removal allows the operator to check the disc periodically to determine if it is freely operative and to remove foreign matter which has become entrapped on the disc.

Manual disc lifting—where permissible—should be done when there is at least 75% of the normal operating pressure in the system, and should be done in a positive manner for a reasonable period of time.

If there are no lifting levers provided, system pressure will have to be increased until the valve automatically relieves, or the valve will have to be removed and dismantled to remove foreign matter by hand.

Set Pressure

Safety valves are set on common fluids — air, water, or gas — most closely associated with the fluid for which the valve is ordered at the pressure requested.

When discrepancies appear between the gage readings and the safety valve settings, it is wise to determine if the gage is remotely enough located with respect to the safety valve so that an appreciable pressure drop exists between them.

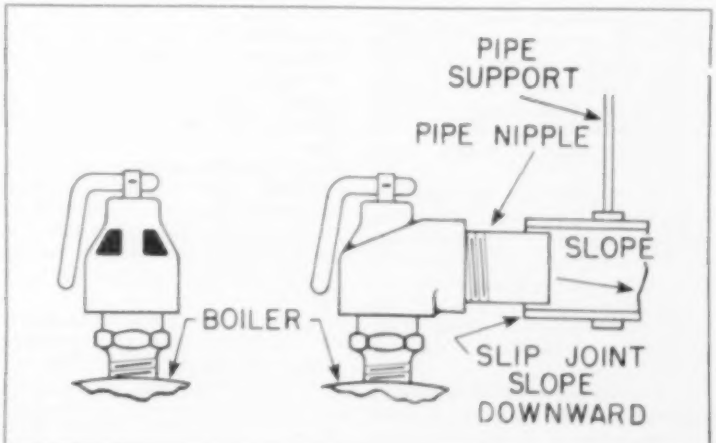
The gage should be relocated as close to the safety valve as possible, and if there is still a discrepancy between valve setting and gage reading, the valve should be returned to the factory for checking.

Cases are on record where the operator reset a pop safety valve to compensate for erroneous gage readings and in the end resulting in bursting the vessel. The *ASME* codes require that valves must be returned to the factory, or be reset by a manufacturer's representative who will properly set and reseal the valve.

When several relief valves are mounted on the same unit, it is preferable to set them at different pressures so that only one will relieve at a time. Since the pressure rise in a system is generally slow, this affords a warning to the operator of the vessel that corrective action is needed, so that when the first valve opens he has the opportunity of reducing the vessel's pressure before losing costly process liquids, or forcing a shutdown.

Another advantage of the stepwise setting of relief valves is that if all valves on a single unit were set at the same pressure, they might tend to "simmer" for some time before relieving. This action is injurious to the valve.

Note: Much of the material in this section is based on an article by E. W. Carr, Supervising Engineer, Crane Company, appearing in *Crane Valve World*, No. 4, 1953.



(Courtesy Crane Co.)

Fig. 8—**Typical recommendations** for safety valve outlet piping

A PANEL OF PROCESSING TECHNOLOGISTS* who bring you with the aid of a wire recorder . . .

Technical Tips on

Catalytic Cracking Problems

Has anyone had experience with severe erosion of cyclones in Fluid catalytic cracking unit regenerators? If so, what type and thickness of material was specified for replacement to give longer life?

What specific type of steel is being used and what welding procedure is proving to be the most satisfactory for cyclones and internal piping in Fluid unit regenerators?

Eckhouse: The first thing to do is to analyze why the problem exists. If you are having erosion, why? Of course, erosion would normally be associated with abnormal velocities in the cyclones. Either the cyclones are too small for the load, or there are other factors which have increased the velocity to the point that they are overloaded.

First, find out why the velocity is high. It may be due to the fact that the unit is operating considerably over the design throughput. In this case, if you are going to continue to run that way and you are having erosion problems, you had better put in bigger cyclones — assuming you have the room to put them in.

If you are not operating at substantially higher than design throughputs, you would have to look for other causes: possibly the use of too much steam, or too much water injection at some point. In general, we haven't had too many problems with cyclone erosion, except where there have been explainable causes for high velocity.

As far as metals are concerned, if you have erosion and your only resort is, say, a change in metal specification or installing a liner: then we would recommend a thicker and heavier carbon steel. We normally use carbon steel. We don't use alloy and we use normal welding procedures. We have tried some acid-proof linings which have not been very successful, and have about given these up.

From floor: There seems to have been quite a bit of successful experience in the lining of cyclones with various metals. I know that in the refinery where I work, the cyclones are lined. And it has definitely extended the life of the metallic elements of the cyclones. I know a number of cases where they have had difficulty when they applied the lining: they put in an overlay of cement. In other words, the cement extended beyond the mesh itself.

In the expansion and contraction—as a result of shutdowns—the overlay would spall off, and plug the dip-leg. However, with people who had cyclones installed which were designed to have a lining (i.e., an allowance was made in the diameter of the cyclone for the lining), results have been successful when the lining was placed flush with the hex steel supporting mesh.

If it's an operating unit and you add a lining, you might make the whole situation worse, because you are increasing the velocity by reducing the diameter. It would have been fine had you designed for that originally. However, we have had very good experience of late with our own particular attack. It seems to work, so we're happy with it at the moment.

Brown: I have one suggestion on the type of iron and steel. I think we would recommend A-285 Grade C, and likely a half-inch in thickness. We have not had a regenerator cyclone failure, but we have investigated enough to know what we think we would do.

Edwards: In one of our units, after about two years of operation, we found that the regenerator and reactor cyclones had lost about half of the original thickness in the main body. We cut the cyclones in half and lined the trouble spots with steel grating and refractory concrete (Q-Panel-chrome), which showed only moderate wear after 15 months of service.

*Left to right: Parker, Eckhouse, Norris, Rippee, Heike, Brown, Feasel, Gearhart, and Wilson. (Edwards was not present for the picture.)

The main problem in lining cyclones, I suppose, is to provide smooth flow and not disrupt the flow pattern. Originally, all of our first-stage cyclones were built with steel grating and Kellcrete. We have some spare cyclones with cast carborundum lining in the spindles, but they have not seen any service yet.

To what extent have centrifugally cast, bi-metal linings been used in air-lift pipes on bead catalyst units, and what is the life span of such linings?

Norris: We have used that type of stub piece on the end of the pipes in several units. The operating Houdriflow units are not all of one design on the lift pipe entrance. The ones that wear, however, wear within the bottom two feet of the pipe, almost invariably. You seldom get wear above that level.

We were able to put stub pieces on the bottom, and several plants have installed stubs. Wear on a carbon steel (low alloy, actually) end might be one-third or one-quarter that experienced with the bi-metal stub. Now, I suppose that they mean by this bi-metal a 28-chrome or something like that being used as the wear surface.

That's not very much information on this subject, but we don't really have a lot of experience with stubs. From what we do know, it looks like it would be about four times the wear, at pipe entrances. This lift inlet system we are using on our new units hasn't shown appreciable wear in several years, so we are using low-alloy carbon steel pipe all the way.

Gearhart: We haven't had long enough experience yet to tell what the life will be: our unit has only been in operation about seven months. We plan to shut down next month and take a very good look at the lift pipe with an Audigage thickness test.

Heike: Are you using carbon steel?

Gearhart: The bottom 36 ft. is the bi-metal casting and made of 27% chrome, 2½% carbon, and about 0.5% molybdenum alloy.

Edwards: On that one earlier question, I might add that on the internal piping in the regenerators, we use type 347 stainless steel welded with 25-20 rods. On the regenerator cyclones and the other structural internals, I think we use ASTM 6011 Grade A firebox carbon steel, welded with E 6011 rod.

Is there a successful method for preventing the fouling of the feed stock side of a Fluid unit feed preheater? If not, what method of cleaning is employed when by-passed by both feed and hot cycle stock?

Eckhouse: We have had trouble on a few units with fouling of that heat exchanger, and we generally have had pretty good luck by gas blanketing the feed charge tanks to reduce the fouling. In most cases, I think it pretty well solved the problem. It is possible, I think, to wash the fouling material out—if you are able to take the unit out of service—by using a light cycle oil or something of that nature. However, that is not too good a solution to the problem.

From floor: What blanket do you use?

Eckhouse: Refinery or natural gas.

From floor: What causes the deposition?

Eckhouse: The deposition is probably due to oxygenated compounds such as peroxides or polymerization products which are formed in the storage tank. The type of feed will be a big factor in the fouling in that exchanger.

From floor: At what temperature would you have to wash that out with the light cycle oil to dissolve polymeric compounds?

Eckhouse: I don't think it would have to be high necessarily: warm, rather.

Parker: I might add that this is a fairly common problem in all catalytic processes where you are charging stocks that have a tendency to pick up any oxygen. We have often encountered the same problem in reforming operations, as well as in cat cracking operations. There seems to be several schools of thought regarding prevention—of which one has been mentioned, the gas blanketing of the charge tank. Another one is some form of feed stripping operation, or using gas to deoxygenate the charge stock before it gets to the hot surfaces where some of these compounds or polymers are laid down.

From floor: How effective are solvents in case it does get fouled up?

Eckhouse: As I say, on cat crackers you would only run into it in a few cases, and we've gas blanketed generally. It would be a surmise that you could do a fairly good job by solvent cleaning without shutting the unit

Ten Experts Answer Your Process Questions

This article is the fourth in a series which began in the March issue, pp. 366-369, providing answers from ten authorities in their fields on a complete range of petroleum processing problems.

Like a similar series we were pleased to present last year, this material is based on a popular day-long session at a regional meeting of the Western Petroleum Refiners Ass'n. in El Dorado, October, 1954. It was obtained by means of a wire recorder by PETROLEUM PROCESSING's editors.

Wide experience was represented by the panel of authorities—five from refining companies and five from suppliers or engineering firms. The moderator was E. A. Heike, chief engineer, Premier Oil Refining Co., Ft. Worth, Texas, who filled the same role in the panel the year before.

The refining group included: J. M. Brown, assistant manager of operations, Pan-Am Southern Corp., El Dorado, Ark.; R. E. Feasel, supervisor of fuels manufacturing, Deep Rock Oil Corp., Cushing, Okla.; J. A. Gearhart, process engineer, American Liberty Oil Co., Mt. Pleasant, Texas; and R. S. Wilson, chief chemist, Lion Oil Co., El Dorado, Ark.

The engineering group consisted of: J. G. Eckhouse, sales engineer, Universal Oil Products Co., Des Plaines, Ill.; O. D. Edwards, sales engineer, Perco Division, Phillips Petroleum Co., Bartlesville, Okla.; D. E. Norris, commercial development engineer, Houdry Process Corp., Philadelphia, Penna.; F. D. Parker, western manager, Blaw-Knox Co., Tulsa, Okla.; and C. W. Rippee, president, Electric Process Co., Summit, N. J.

This month's article continues the discussion of questions pertaining to catalytic cracking begun last month. Other subjects to be covered in forthcoming issues will include reforming treating, corrosion, and many miscellaneous plant problems.

down. Although I don't know if we've actually done much of that, it would be just a guess.

Edwards: We have faced that same problem in a number of our fixed bed units, reforming units, and our experience bears out on what has just been said. Keep the air out of the feedstock: and you do that by gas blanketing. The solvency of that low temperature carbonization product is almost complete in any aromatic. At least in one of our units we have seen that the reformate will almost completely dissolve all of the feed-side polymeric material or whatever it is.

What happens to carbon residue charged to a catalytic cracking unit? What part goes to coke formation?

On vacuum distillation unit sidestreams to be used for cat cracking feed, what is the percentage of carbon residue?

Norris: As far as we're concerned, the carbon residue that goes to the cracking unit is coke to a pretty high degree. It appears to be a fundamental of catalytic cracking that the carbon content, free carbon, or carbon residue, can't become much of anything but coke.

From floor: We have charged vacuum oils with as high as 4%.

From floor: You mean you got a vacuum unit side stream of 4% carbon residue?

From floor: Yes, but not as a steady operation.

Eckhouse: Of course, there is no profit in charging coke to a cat cracker. With a properly designed vacuum unit, you should be able to hold the carbon residue down to around 0.25% or less. In some cases we have had carbon residues quite a bit higher, but we've ordinarily been able to cure that problem through close attention to the vacuum unit design and operation. Again, I think it isn't how high it can safely go, but how do you keep it low. The problem isn't to cure the patient after he's sick, but how to keep him from getting sick.

Parker: I can quote some second-hand figures which probably are available first-hand to you operators. A normal vacuum unit should produce gas oil of 0.3% Conradson carbon or less. A number of devices have been used—such as woven metal pads, etc. —which in some cases have shown rather astonishing reduction. They have brought a gas oil of 0.37 carbon residue down to 0.1%, which is the right way to cure the problem.

This also ties in with a previous question about coker gas oil, which represents an increasing percentage of charge stock to cat cracking. The same principles apply there. It's not so much the process of coking that creates the problem as it is the after-fractionation and cleaning up of the coker gas oil that you intend to crack. Just as much attention has to be directed toward the fractionation system on the coker gas oil as would be toward the vacuum unit preparing your vacuum gas oil.

From floor: Well, if a metal pad is used, is it common practice to supply a spray immediately above the pad?

Parker: One school of thought says "yes," and the other says "no." My personal opinion is that a dry pad will do as good a job, or even better, than a wet one. I don't think there are any conclusive data on the subject.

From floor: If a spray is used, doesn't most of it end up in the bottoms?

Parker: The pad is really a form of tray for separating out entrained liquid from a vapor stream, and if the pad is working properly you can flush down through it, and reject that material out the bottom. On the other hand, since it also separates without the spray—if there is a way to get the separated material to flow down to the bottom without a spray—then you haven't done any good by adding the spray.

From floor: In operating the vacuum unit in the range of 750 to 800° F., using a spray would be a tendency to increase coking and clog the pad.

Parker: That's why I say, it's more or less a matter of opinion whether to operate dry or wet. A spray just introduces more compounds which can coke and clog up the pad. A pad properly installed and properly drained should work without any spray.

From floor: About four years ago, we had a blanket installed in a vacuum tower which the installer insisted had to be sprayed or periodically replaced, as it would run only about two years without plugging or getting a hole in it. We have not done that, and we have had very satisfactory operation. And we have never disturbed the original blanket. We are trying to make asphalt off the bottom of this tower, and do not wish to soften the asphalt with a solvent spray. That unit is just as bright and pretty now as it was the day we put it in. The bottom temperature is 770° F., and almost the same at the midsection of the tower.

Norris: It's probably a function of the stock going through. Some stocks coke a lot easier than others.

From floor: I've heard it said, "Don't put any vis-breaker stock through a blanket or pad."

Parker: I can't cite any direct experience on cokers which represent a comparable problem. We have not used any blankets in coker fractionators, and have no operating history on them.

Norris: I'll say this: as far as the carbon residue is concerned in a heat-balance unit where you're returning some slurry to maintain heat balance, I don't see much difference whether you return slurry or carbon residue.

Wilson: We have a stream which was running approximately 1% carbon residue. We put in a mist extractor and reduced it to about 0.2%. It's been in operation about a year now.

Eckhouse: I think that is a good point. Normally high carbon residue is also associated with high metals content. Therefore, even though carbon itself may not be a problem (if a unit has enough carbon burning capacity), it becomes a problem because of the high metals content associated with carbon.

Who Were the Experts?

E. A. Heike, Premier Oil Refining Co.

J. M. Brown, Pan-Am Southern Corp.

R. E. Feasel, Deep Rock Oil Corp.

J. A. Gearhart, American Liberty Oil Co.

R. S. Wilson, Lion Oil Co.

J. G. Eckhouse, Universal Oil Products Co.

O. D. Edwards, Phillips Petroleum Co., Perco Division.

D. E. Norris, Houdry Process Corp.

F. D. Parker, Blaw-Knox Co., Chemical Plants Division.

C. W. Rippee, Electric Process Co.

'Foam' Roof Cuts Product Losses

Evaporation of motor gasoline reduced 60% using plastic spheres in cone-roof tanks

LOSS of gasoline by evaporation when stored in cone-roof tanks can be cut by as much as 60% through the use of "Microballoons." That's the conclusion reported recently by researchers with Standard Oil Co. (Ohio) after extensive laboratory, pilot and field tests.

Comparable savings in evaporation losses with other products, particularly jet fuel, are also indicated by laboratory tests, but have not yet been confirmed in the field.

Microballoons are hollow, microscopically-small, gas-filled plastic spheres which float on the surface of a liquid stored in a tank and form a foam-like seal. They were developed in the laboratories of Standard of Ohio, and were first announced in July 1953.

Earlier work with Microballoons was devoted mostly to their use in crude oil storage tanks, where they were shown to reduce losses by about 80-90%. The latest work is the first reported on the use of this material in product storage. The information was contained in a paper prepared by Frank Veatch and R. D. Croft of the Chemical and Physical Research Division of Standard of Ohio, and presented by Dr. Veatch before a meeting of the Evaporation Loss Committee of the American Petroleum Institute in Chicago, May 4.

Although the work reported was concerned with secondary product storage in marketing operations, Dr. Veatch expressed the opinion that refiners still using fixed roof tanks for product storage should be interested in the results.

Preliminary test work on the use of Microballoons in product storage was carried out in a group of 55-gal. drums, equipped with 2-in. open vents. The drums in pairs were half filled with the product under test, and a 1-in. layer of Microballoons used in one of each pair.

Gages were made two to three times weekly over a 45-day period under static storage conditions, the loss rate determined, and the percentage of reduction in loss calculated.

Four products were tested in this manner—regular motor gasoline, tractor fuel, JP-4 jet fuel, and No. 1 fuel oil. Reporting on the results of this program, the paper states that "the most volatile stock, gasoline, evaporated at the highest rate, and a loss reduction of 45% was obtained. The highest percentage reduction in loss rate was obtained with jet fuel, a substantially wider boiling range stock than gasoline although appreciably less volatile so that absolute loss rates were substantially lower. The quantity of material saved, however, was highest with gasoline. . . . No. 1 fuel oil did not undergo any detectable evaporation loss during the 45-day test period."

A tabulation of the results of these tests is given below:

	— Loss Rate* — Control	**Protected	% Loss Reduction
Gasoline	10.5	5.7	45.7
Tractor fuel	5.1	2.6	49.1
Jet fuel	5.4	1.9	64.8
No. 1 fuel oil	0.0	0.0	———

* Gal./1000 sq. ft./day.
** With 1-in. layer of Microballoons.

Pilot-scale tests in 40-bbl. tanks alternately filled and partially emptied to simulate worked conditions confirmed the results for gasoline storage. In these tests, evaporation losses were reduced by 60-65% over a period of 54 days.

Two different types of commercially-available Microballoons were used—urea resin and phenolic resin, and different thicknesses of layers—⅝, ¾ and ⅞ in. No apparent differences existed in the effectiveness of the various layers, the researchers reported, although there was an indication of better performance from the slightly thicker layers.

Field tests gave final confirmation of the effectiveness of a Microballoon covering in gasoline storage. Here two actual working bulk station tanks were used—both 11-ft. diameter by 25 ft. high, aluminum painted.

Since these tanks were to be kept in service, and since receipts and deliveries were made many times daily and at all hours, measurement by gaging wasn't practical. Instead, direct liquid metering was used. The tanks were gaged twice a week, and losses calculated then on the basis of the differences between the actual inventories as shown by gaging and the calculated inventories as shown by the meter readings. All figures were adjusted to 60° F.

The field tests were conducted in three phases, described in the report as follows:

"The first phase was a dry run for 16 days with no Microballoon layer on either tank, to make sure they were losing gasoline at the same rate. Both tanks showed evaporation rates of about 145 gal./1000 sq. ft./day.

"A 1-in. layer of Microballoon spheres was then installed in the test tank with measurements taken for 46 days. Loss was reduced 52%. During this second phase visible Microballoon-particle wall hold-up was observed and occasionally bare gasoline spots could be seen beneath the gage hatch. Inspections showed the bare spots were produced by turbulence during receipts into the tanks from refinery trucks. The bare areas appeared to seal over after a few hours. They were most frequent when the liquid level was low since turbulence was highest then and the covering was thinnest.

"In the third phase of the test, sufficient additional material was added to give an over-all calculated layer thickness of 2 in. and the test was continued another 26 days. A 63% loss reduction was obtained and the additional quantity of material almost completely eliminated the occurrence of bare spots on the surface."

Economic calculations based on this field test indicated that the product saved because of lowered evaporation rate would pay for the installation of the 1-in. layer in 6.5 months, and the 2-in. layer in 7 months. These figures are based on estimated installation costs, including the cost of the Microballoons (at the going market price), accessories, tank cleaning and labor.

As a result of this test work, Standard of Ohio plans to protect practically all of its secondary bulk gasoline storage with Microballoon layers during the next few months.

Earlier Articles

Two earlier articles describing the use of Microballoons have appeared in PETROLEUM PROCESSING:

"Foam Floating Roof Pays Off," December 1953, p. 1884.

"Foam Cuts Vapor Losses," July 1953, p. 1017.

NOW IF YOU ASK ME—O. C. Dillon and R. B. Chesney, both of Sunray Oil Corp.

GOT IT HERE—K. Short, Phillips Petroleum, Stanley Davis, Texas Pacific Coal & Oil, and P. Goth, Jr., Phillips

With the NGAA in Dallas . . .

1955-56 OFFICERS—Vice Presidents W. F. Matheny, H. W. Harts, and G. T. Tennison; President A. H. Weil; and Vice President C. D. Gard

● Officers of the Natural Gasoline Assn. of America were elected for 1955-56 during the 34th annual convention in Dallas April 15. President is A. H. Weil, United Gas Pipe Line Co., Shreveport. Mr. Weil is a former vice president of NGAA.

Re-elected as vice president at the convention were W. F. Matheny, Sid Richardson Gasoline Co., Ft. Worth, and G. T. Tennison, Shell Oil Co., Houston. Elected vice president for the first time were H. W. Harts, Warren Petroleum Corp., Tulsa, and C. D. Gard, Union Oil Co. of California, Los Angeles. William F. Lowe continues as the group's secretary-treasurer.

WHAT'S IN THIS PROGRAM?—F. L. Crawford, Magnolia Petroleum Corp., and W. L. Todd, Gulf Oil Corp.

HERE'S THE WAY I SEE IT—Frank E. Galle and Edward E. Alsup, both of El Paso Natural Gas Co.

WAIT'LL I SPRUCE UP—W. F. Lowe, NGAA, and R. G. Murray, Jr., Sutton-Williams Bros. Ltd.

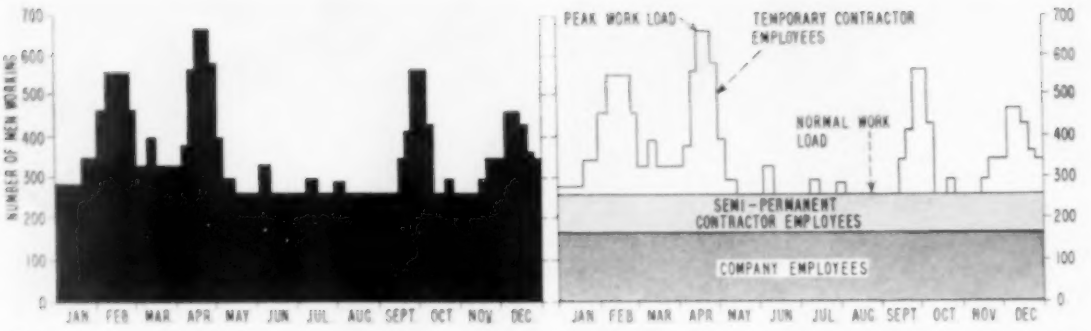
YOUNG MEN WITH A JOKE—John Horn, Phillips Petroleum, C. W. Brady, Sinclair Oil & Gas, and Jim Mims, Phillips

NOW THAT'S A TOUGH ONE—W. H. Vaughan, Tide Water Associated Oil Co., and R. C. Frederick, Gulf Oil Corp.

WHO'S OVER THERE?—L. O. Crockett, Gulf Oil Corp. and Dr. E. D. Crittenden, Allied Chemical & Dye Corp.

HERE'S MY BADGE—W. Nixon, Union Petroleum, Fred Schwend, Warren Petroleum, and W. Bowser, Atlantic Refining

CONFIDENTIALLY—Melvin Burscheidt, Tide Water Assoc. Oil, and E. R. Millett, Jr., California Natural Gasoline Assn.



HERE'S A BOOST OVER THOSE PEAKS. How temporary contract labor can augment company and semi-permanent crews (right) over typical load variations (left)

Work Load Problems?

Try Variable Contract Maintenance

FLUCTUATING work loads, a maintenance problem of increasing importance in today's petroleum processing plants, can be solved a number of ways.

A combination approach, backed by six years of experience in the Los Angeles and Oleum, Calif., refineries, is the way Union Oil Co. of California likes to handle it. They hire temporary crews of variable size to work along with their own company forces and semi-permanent contracted crews.

The way it works is illustrated graphically in the two charts above. During periods of normal work load, the 175 permanent company maintenance men plus the 100 semi-permanent contracted mechanics can handle all necessary jobs. During a typical peak load period—for example a major unit shutdown—an additional 400 temporary workers are contracted for, bringing the total force up to 675.

The multiple problems this solves were brought out in a paper scheduled for presentation by John W. Towler of Union at the mid-year meeting of the Refining Division, American Petroleum Institute, St. Louis, Mo., May 12. These include such factors as:

- Refinery maintenance personnel requirements can fluctuate widely during periods of emergency shutdowns.
- Besides the unexpected peak work loads, scheduled maintenance may require entirely different craft distributions from job to job. One unit may need a majority of pipefitters: the next may require a majority of boilermakers.
- Unexpected items — even on scheduled shutdowns — are often discovered when equipment is inspected, despite detailed historical inspection records.
- All the constantly changing and frequently unpredictable shutdown manpower requirements are always superimposed on a relatively constant amount of maintenance to other on-stream units.

There are four solutions to such problems, the way Union Oil saw it:

1—Employ a constant maintenance crew in the refinery at all times. This can be done by use of a combined planning - scheduling - priority method in which the backlog of minor construction and maintenance work is postponed during turnarounds and other peak load periods. For examples see, "Maintenance Dividends for You" by C. C. Carmine, PETROLEUM PROCESSING, Feb., 1955, pp. 192-7, and "Minimizing the Refinery Maintenance Crew," by F. C. King, API Refining Div. mid-year meeting, 1954.

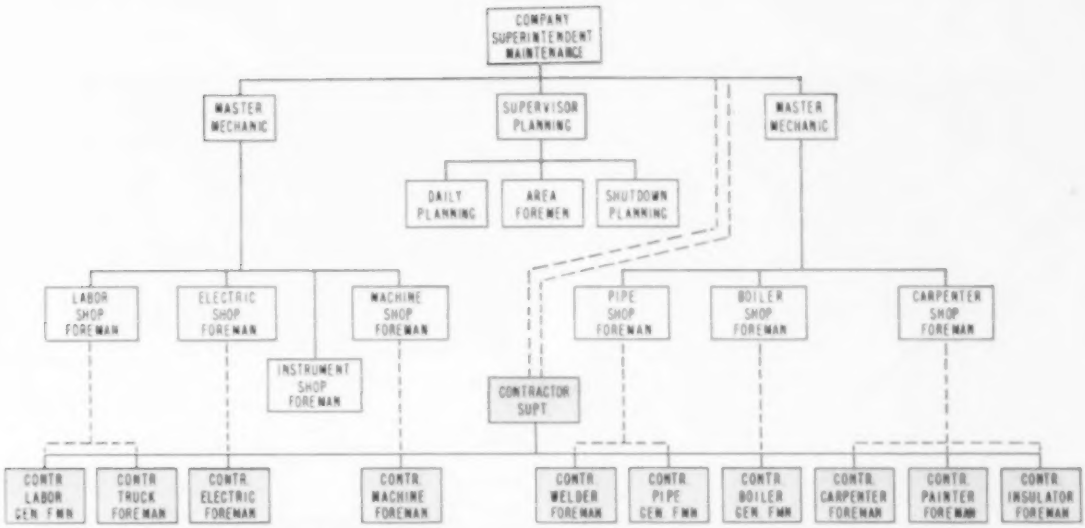
2—Fluctuate company manpower for maintenance needs by making temporary transfers from operating departments, hiring some outside labor, and temporarily upgrading personnel within the company maintenance crews. This method is being used by some refineries who have found that long-range planning, coordination, scheduling, and the use of normally-contracted construction work to balance does not give them an economically constant work load. Backlogs become excessive and important new construction is delayed.

3—Handle turnaround maintenance by contract labor on a specified portion of all peak turnaround work. Outside contractors furnish their own craft supervisors prior to the shutdown to survey and estimate the work to be done. Difficulties arise, however, in that these new and often large, multiple craft crews are almost completely unfamiliar with many essential refinery work methods and procedures. This makes it difficult to plan safely, coordinate, and record the activities of the crews.

4—Use variable contract maintenance, composed of permanently assigned company maintenance personnel, augmented by a nucleus of contractor crews supplied under general maintenance contracts. This is the method Union Oil selected and uses today.

How the idea developed: Several years ago Union Oil instigated the policy of augmenting their regular company maintenance crew so that under normal work load requirements between major unit shutdowns, a small nucleus of contractor maintenance people were kept in the refinery just to meet the normal maintenance needs.

Between peak loads, these contractor mechanics were kept to the minimum number—by craft—which could be used as general and working foremen during periods of maximum manpower needs. This nucleus was regarded as semi-permanent, was hand-picked for ability, and had the advantage of being familiar with the refinery units and work procedures. The way it fits in has been illustrated in the charts.



HOW TO FIT CONTRACT CREWS INTO COMPANY ORGANIZATION is shown in this chart Union Oil's refineries use

What the contracts specify: General maintenance contracts at the company's Los Angeles refinery are written with one contractor supplying all crafts except painters, insulators, electricians, and brickmasons. These are supplied by individual specialized contractors. At the Oleum refinery, one contractor supplies all crafts except the instrument men (who are company employes) and brickmasons, again supplied by a specialized contractor.

Cost plus a percentage for field-office expense, overhead, and profit was typical of contracts until 1953, with the percentage based on direct labor costs. At that time, the Oleum refinery changed the contract to a guaranteed percentage fixed fee on an estimated yearly payroll.

Direct labor rates are negotiated by the general maintenance contractors with local craft and labor unions. Higher construction rates, plus contractors fees are partially offset by fringe benefit costs which are a part of company craftsmen rates, but the cost per hour of contractor labor still exceeds that for company craftsmen.

Labor union requirements also specify the use of union foremen of a definite number based on crew size and foremen rates.

The contract maintenance organization, shown in the chart, is headed by a superintendent responsible to the Union Oil maintenance superintendent. A field office is supplied to the contractor superintendent and his staff.

No change is made in the company maintenance organization by the presence of the contract maintenance force. Company shop foremen are responsible for work in their crafts whether performed by company or contract crews.

How work is planned: Day-to-day maintenance is authorized on job orders by the operating departments. Work is defined by craft sequence in detail, estimated, and given priority by area foremen assigned to the five refinery zones.

Orders are distributed by the daily planning group to the craft shop foremen for inspection and ordering of materials needed.

After notification by shop foremen that material is available, the schedules are prepared for each craft, containing individual craft sequences by priority, and are distributed one day prior to schedule to affected operating and maintenance foremen.

Work is scheduled so that the work backlog always pushes the craft forces. Planning is used also as a basis for reviewing backlogs and contract maintenance men requirements.

Work direction: The planning group proceeds with future scheduling on the assumption that all scheduled work was completed unless there is notification to the contrary.

Either company or contractor craftsmen are assigned to cover the scheduled work, and have authority to draw on company stocks for needed tools and supplies.

Company craftsmen receive instructions from shop foremen, while contractor craftsmen receive directions from contractor subforemen. However, the company shop foremen still remain responsible for maximum utilization of all manpower, tools, and equipment and must insure that craftsmen have received proper instructions, use proper methods, and are assigned to alternate work when job delays occur. Also he sees that correct tools and equipment are at the job site.

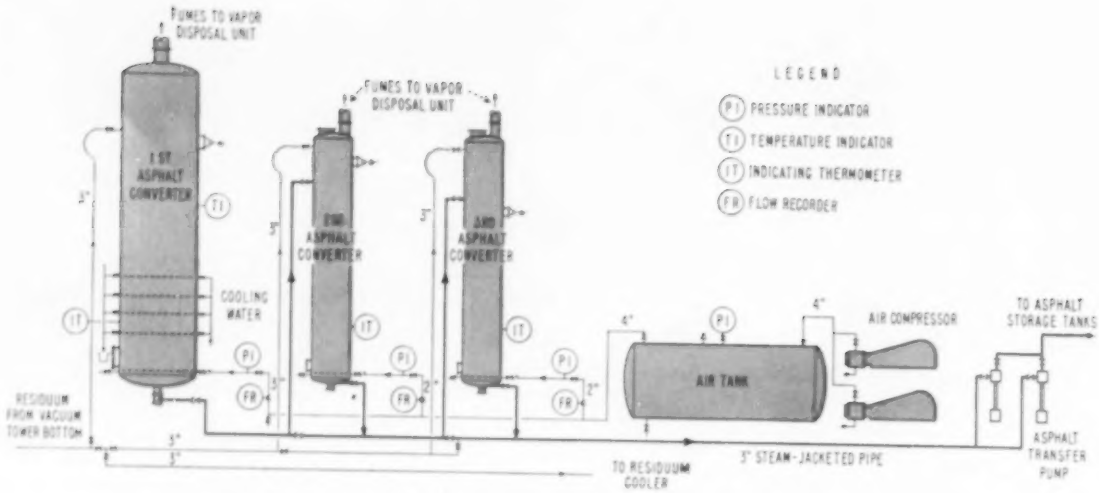
Turnaround work is handled in much the same manner as other maintenance work. It is planned and estimated by detail for crafts and compiled into a master daily schedule. Shutdown timing is coordinated with the operating departments and the general contractor supplying temporary maintenance personnel.

Uncompleted or new work is fitted into the master schedule for succeeding days where allowances have been made for such occurrences. As work is completed, the contractor is requested to reduce his crews.

Controls: Craft time and materials are distributed against job order numbers selected to accumulate charges against specific equipment throughout the refinery.

A monthly statement is distributed to the supervisors responsible to show monthly and year-to-date charges for their equipment. A monthly budget control statement is also distributed to show total accumulated job charges compared with those budgeted with specific areas of responsibility.

In addition to the general contractors, numerous specialized maintenance and construction contractors are used. Union Oil has had considerable success with these small contractors, especially under fixed-cost contracts. Examples of contract work so handled are tank cleaning, tank car repairs, furnace brickwork, wharf repairs, major painting and insulation, weed control and levee maintenance, and dismantling of facilities.



Continuous air-blowing process for asphalt at Kaohsiung refinery

Why Is Continuous Asphalt Best?

Five distinct advantages can result from the continuous manufacture of air-blown asphalt as compared to the batch process.

A continuous unit with three vertical converters, installed in the Chinese Petroleum Corp.'s Kaohsiung refinery at Taiwan, China, has shown these results:

Lower equipment and maintenance costs due to the elimination of converter heating facilities.

Blowing time cut in half due to greater equipment efficiency, resulting in greatly increased throughputs.

Greater air-blowing efficiency, reducing air requirements as much as 87% for making 220 softening point product from 100 softening point feed stock—air requirements for batch blowing were around 6000 cu. ft./bbl., but only 850 cu. ft./bbl. in the continuous unit.

Better quality asphalt—being free from carbons entering the asphalt from "stalactites" that form in the horizontal batch still during the splashing caused by air-blowing.

Greater ease of control and operation on a continuous basis than on the batch basis which required repeated filling, heating, and discharging operations.

Batch Blowing Shortcomings

Batch manufacture of blown asphalt is generally carried out in horizontal blowing stills. The oxidizing air enters the top of the still through a pipe which extends to the bottom of the still, feeding into an air header running the length of the still. Perforated laterals are connected onto the air header on both sides at right angles, curving parallel with the side of the still.

A given quantity of vacuum-reduced heavy residuum is charged to the still and then heated to the desired blowing temperature by direct fires underneath the still.

During the period of heating, a small quantity of air is introduced to the still though the air header and laterals to agitate the oil.

When the oil is heated to the desired temperature, the fires are cut and the blowing of the residuum is started by introducing copious quantities of air into the air header. The air-blowing continues until the result-

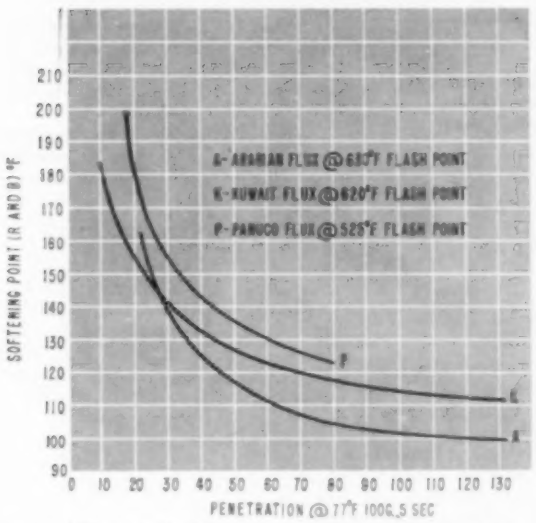

SOFTENING POINT (R AND B) °F
PENETRATION @ 77°F 100G,5 SEC
A- ARABIAN FLUX @ 685°F FLASH POINT
K- KUWAIT FLUX @ 620°F FLASH POINT
P- PANUCO FLUX @ 525°F FLASH POINT

FIG. 1—Effect of air-blowing on vacuum residua from different crudes

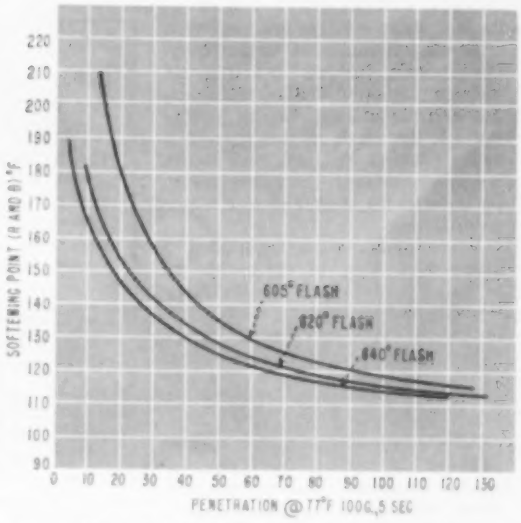


Fig. 2—Effect of air-blowing on Kuwait vacuum residuum with different flash points

ant asphalt meets the desired hardness specifications.

It is reported that for an 800 bbl. capacity air-blowing still, the blowing cycle runs from 22 to 30 hours, depending upon the penetration grade of asphalt desired.

A typical batch air blowing time cycle is shown in Table 1. It will be noted from the example that not only is an excessively long blowing cycle required for the batch process, but that a considerable amount of time is lost in the charging, discharging and heating of the batch still.

Material transfer and heating alone are almost one-half the blowing time for softer grades of asphalt, and almost one-third for the harder grades. In other words, the time used for converting or blowing is actually two-thirds to three-fourths of the whole blowing cycle.

These long handling, heating, and blowing cycles result in very small throughputs for the size of the unit.

In addition, pipe stills or fire boxes are generally used to heat the residuum charge stock to the desired temperature. The installation of these heating devices increases both the initial and the maintenance costs of the process equipment.

Continuous Blowing Advantages

by ***YUN-NAN FAN***
Kaohsiung Refinery
Chinese Petroleum Corp.
Taiwan, China

In view of the long blowing cycle and high installation cost of batch asphalt equipment, the Chinese Petroleum Corp., Taiwan, China, has installed a battery of continuous asphalt blowers in its Kaohsiung refinery to save both time and cost.

The flow diagram of the continuous asphalt manufacture equipment is shown on page 862. Three vertical columns are used, each insulated with three inches of rock wool. The first asphalt converter is the largest, and the only one with provisions for controlling the heat of reaction during air blowing of the asphalt. The following two columns serve as stabilizers for the asphalt, or as surge capacity for high feed rates.

The feed stock is charged directly from the bottom of the vacuum fractionator at a temperature of about 600° F. into the first asphalt converter—at which time the feed stock is cooled to 450 to 500° F by water circulating in the converter cooling coils.

Residuum heating is eliminated in the continuous process, and therefore the equipment and time required for heating is also eliminated. In addition—due to the continuous nature of the process—charging and dumping times are eliminated from the process cycle.

Air-blowing time is cut in half—compared to the batch process—and the total amount of air needed is materially reduced for the continuous process.

In operation, the residuum feed stock enters the first—and largest—of the three conversion columns. After the charge level builds up, the oil overflows into the second, and then the third converter.

Air for blowing enters the bottoms of the converting columns by means of spider distributors with one-eighth inch diameter holes at one inch center to center distances. A 400 cu. ft./min. motor-driven air compressor serves to supply the air which is first delivered to a large air tank at 18 psig, and then to the converter spiders.

Each air line has a stop valve, a check valve, and a manual control valve between the air supply tank and the spiders. Flow meters are also installed on each air line in order to indicate the quantity of air passed into the converters during the blowing process.

Converter temperature is maintained by the exothermic nature of the reaction between residuum and air. In case the reaction becomes too severe, cooling coils have been installed at the lower half of the first asphalt converter to aid in removing excess reaction heat.

Blowing procedure varies somewhat for different grades of asphalt, and for feed stock residuum from different crudes. In general the hot vacuum residuum just drawn from the bottom of the crude vacuum tower has a flash point of 620 to 640° F. This residuum is pumped through a 3-in. line to the top of the first converter.

When the first converter is filled with residuum to about one-fourth of its height, air-blowing is begun by opening the air valve, then opening

the stop valve into the first converter.

Blowing is continued as the charging proceeds, the air bubbling up through the hot residual oil and reacting with the hot oil. The air passing through the residuum keeps it in a violent state of agitation, and carries reaction produced gases and fumes up through the stack and to a vapor disposal unit.

When the first converter is filled to within 5 ft. 6 in. of the top — as indicated by the liquid level indicator —giving a final blowing head of 19 ft. and an ample space above the liquid level for breaking foam produced by the air blowing, the bottom discharge valve is opened. This allows hot oil from the first converter to be gravity-forced through a 3-in. steam-jacketed line and into the top of the second converter. The elevation of the overflow line into the second converter is three feet below the liquid level indicator of the first converter.

The second reactor is operated similarly as the first reactor, with overflow going to the third reactor. Then, when the level of the third converter is built up to the desired height, residual oil is switched to a slop tank by passing through a residuum cooler while the blowing on the converters is continued.

As soon as the penetration of the asphalt from the third converter reaches the desired value, residuum is again fed into the first converter.

By adjusting the quantity of air used in the converters, on-test asphalt is produced and pumped to the storage tank from the bottom of the third converter ready for drum filling.

Shifting residuum to the slop tank from the first converter—after the third converter is filled during start-up—and then shifting the residuum back to the first converter after asphalt from the third converter reaches specification hardness has been found to be good practice by the Kaohsiung refinery personnel. The shifting operation—in place of the alternative of continuing to charge the residuum to the first converter and pumping off-test asphalt to the slop tank—eliminates the possibility of clogging the slop line during cold weather.

Table 1—Typical time cycle for batch manufacture of air-blown asphalt

Time for charging and discharging still, hrs.	3.5
Time for initial heating of residuum, hrs.	3.5
Time for air blowing of residuum, hrs.	15 to 23

Asphalt Quality

Residuum and asphalt obtained from Kuwait crude have their properties summarized in Table 2.

Both the quantity of blowing air and the time required for blowing vary with the types of residuum being used. Some residua are much more sensitive to air than others, and the reaction with air is more violent.

Most economical conversion—as a general rule—has been found by introducing air into the residuum at about 10 cu. ft./min. per ton of 70 to 85 penetration grade asphalt, up to 15 cu. ft./min. per ton of 50 to 70 penetration grade asphalt. Blowing time runs from about 4 to 8 hours, depending upon the grades of asphalt being made.

Different crude sources as related to the effect of air blowing on softening points and penetrations on the residua from the vacuum still at the Kaohsiung refinery are shown in Fig. 1.

Kuwait crude residual produced with three different flash points, illustrates the effect of air blowing on different grades of residua in Fig. 2.

The first asphalt converter is usually large enough to convert 350 b/d of 620° F. flash point residuum derived from Kuwait crude. The conversion is from about 120 penetration to a 50 or harder grade asphalt using 12 cu. ft./min. per ton of 18 psig air. The second and third converters are usually used for stabilizing the finished asphalt from the first converter.

Blowing is carried out in the second and third converters only when the properties or the charging rates of the residuum are changed; when other grades of asphalt are required; or when the amount of blowing possible in the first converter is not adequate for the desired asphalt hardness.

Topped crude derived from various sources other than Kuwait have been run in the vaccum still at the Kaohsiung refinery. Since the asphalt content is different for different topped crudes, the capacity of the asphalt converter must be flexible enough to allow for the handling of various quantities of residuum.

In the past several years the vacuum still of the Kaohsiung refinery ran a topped crude reduced from Arabian crude. The asphalt blowing unit converted 300 b/d of 50-60 penetration grade asphalt.

During 1953, the vacuum still ran Panuco asphaltic crude. The residuum from Panuco crude required shorter air-blowing periods and the unit converted 600 b/d of 50-60 penetration grade asphalt.

Table 2—Residuum and K.O.R. No. 1 grade road asphalt from Kuwait crude

	Kuwait Vacuum Residuum	K.O.R. #1 Asphalt
Specific gravity	1.0187 (60°/60°F.)	1.0228 (77°/77°F.)
Recovery from crude, volume %	19.35	———
Flash point (C.O.C.), °F.	620.	635.
Softening point (R&B), °F.	109.	127.
Penetration at 77° F., 100 g, 5 sec.	131.	50.
Ductility at 77° F., 5 cm/sec.	over 130	over 130
Solubility in CS_2, % by wt.	———	99.902
Solubility in CCl_4, % by wt.	———	99.878
Loss on heating, % by wt.	———	0.0094
Penetration after loss on heating	———	45 at 77° F.
Spot test	———	negative

Acknowledgment

The author wishes to express his appreciation to Kaohsiung refinery for permission to publish this manuscript, and to acknowledge the valuable suggestions made by J. T. Sheen, vice-president of the Chinese Petroleum Corp., T. C. Fei, director of the Technical Service Division, and T. L. Yu, superintendent of the Lube plant during the preparation of this manuscript.

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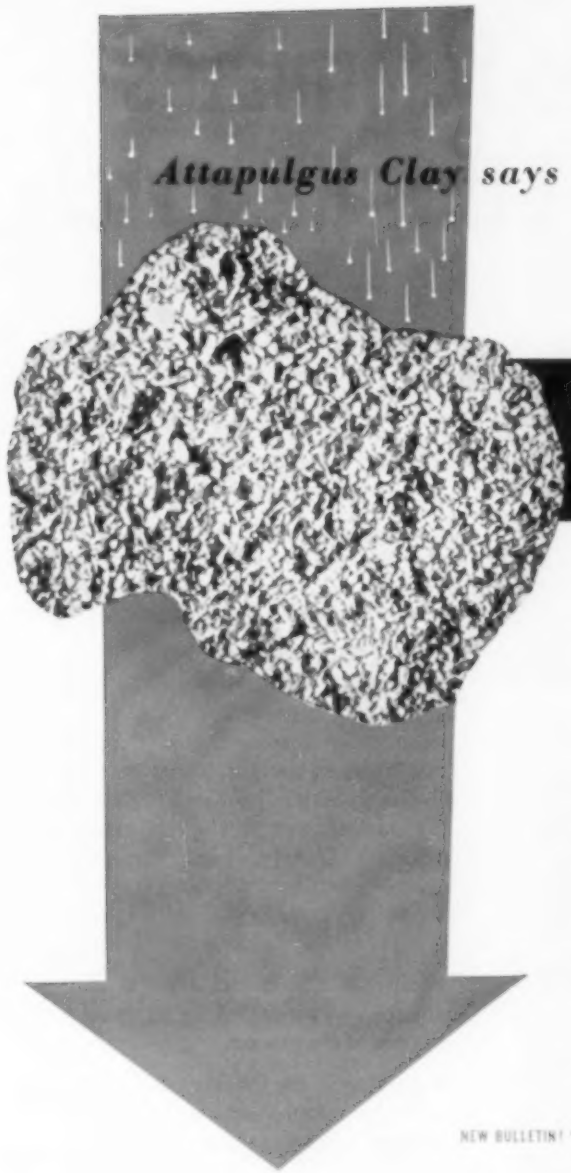

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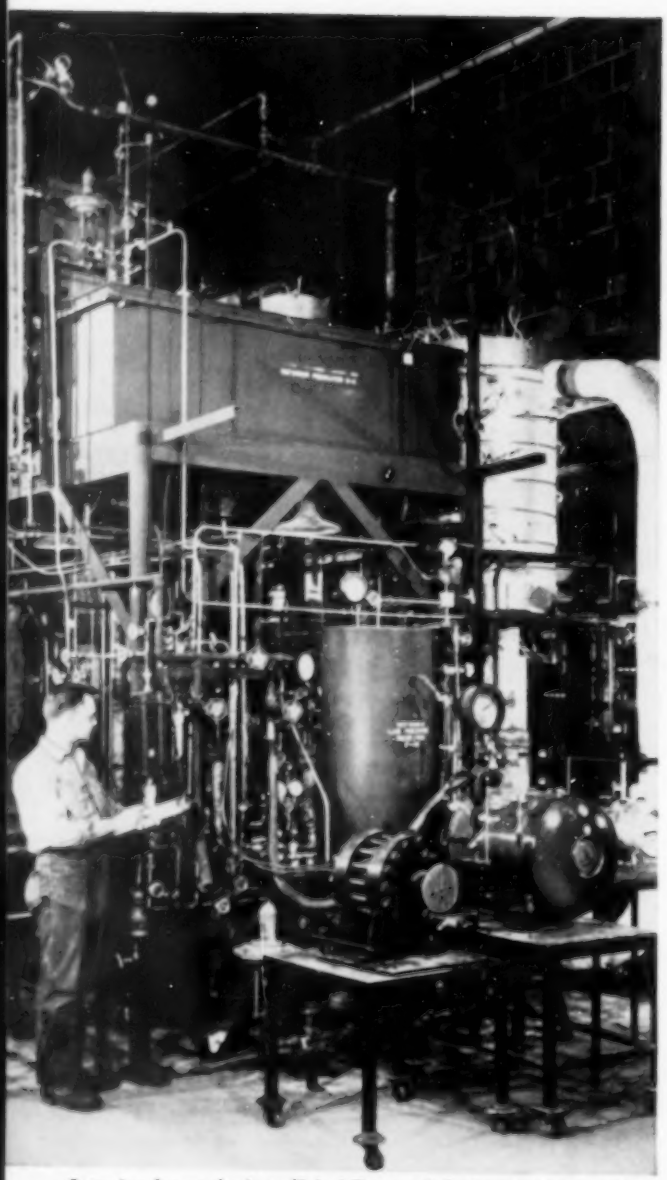
New catalytic reformates road-tested by Ethyl Research



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Petrochemical Section

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Three factors for the small refiner to keep in mind when he gets into petrochemicals manufacture—p. 871

Petrochemical Safety

Here's help on four points: designing it in before you build, how to handle toxics, and tips on two specific processes—p. 876

Aromatics Recovery

B-T-X is a pivot for Cosden's petrochemicals—p. 871

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Size Is No Bar to Petrochemicals

How the smaller refiner can get in, and three factors it will pay to keep in mind

COSDEN Petroleum Corp. of Big Spring, Texas, is a small refiner who has found big profits in the petrochemical field.

In 1946 Cosden was in no way involved in petrochemical operations. Today, petrochemicals account for a large part of the company's net profit. Capital investment for petrochemical operations by Cosden and others adjacent to the refinery exceeds $6,000,000.

Cosden's philosophy—any product derived from crude oil is within the province of a refiner. If he has petrochemical materials—he should use them. Why burn up potential profits?

Cosden's advice to petrochemical newcomers:

- Use common business sense . . . the profitability of a petrochemical operation is based on the same type of economic considerations as any other refinery process.
- Recognize your experience . . . there is little difference between a polymerization process to make a fuel and one to make a petrochemical.
- Decide how to market . . . does the petrochemical have the volume to merit organizing your own sales staff—or will it be better to sell to an already established company with a specialized sales staff?

How Cosden did it is explained on the following four pages by Wm. K. Jackson, who is director of Cosden's organic chemicals division, and by Dan M. Krausse, who is manager of manufacturing.

The company is now selling such valuable nonfuel products as carbon black oil, mercaptans, polybutene, and the like, in addition to the more conventional materials like the benzene-toluene-xylene aromatics.

For details on How Cosden Did It, please turn page

It's an Easy Road from Conventional Fuels

By W. K. JACKSON and D. M. KRAUSSE
Cosden Petroleum Corporation

REFINERS have been fuel producers for so long that to some the manufacture of chemicals seems to be an exotic and foreign type of business.

While petroleum had been recognized as a rich source of raw materials for synthetic organic chemicals for many years, the interest was primarily academic for several generations because earlier straight-run petroleum fractions were not readily adaptable as synthetic organic chemical raw materials. Coal tar distillates had provided a rich source of economical raw materials.

Government encouragement during World War II brought the first great commercial acceleration of petrochemical processes. After some of the earlier process "bugs" were eliminated, many of these processes were found more attractive than had been estimated originally.

Today the petrochemical increment—for synthetic rubber, plastics, etc.—in the total chemical business is greater than was the total chemical business in 1940.

Some of the larger refining companies took early advantage of the opportunity to diversify their operations by manufacturing petrochemicals. However, to be a pioneer requires courage based on firm convictions, a healthy bank account, or Government backing. Since 1940 all of these have been present, plus increased markets; hence the spectacular rise of petrochemicals.

It is our conviction that the small refiner too can profitably exploit petrochemicals opportunities if he exercises normal business prudence and recognizes that he is actually already experienced in chemical manufacturing techniques. He knows how to do it and he has the materials—so why burn potential profits?

Venturing into the petrochemicals field does not constitute any major departure from the normal and regular habits of the refining business.

The profitability of a petrochemical operation must be based on exactly the same type of economic consideration as the profitability of any other type of refinery process.

Cosden's own experience supports this conviction and we will give a chronological account of Cosden's petrochemical history.

Until late 1946, Cosden produced only various sorts of fuels. Technological improvements in refining practice, changes in accessibility to market areas, and a growing population in West Texas made it apparent that modernization and process improvements were absolutely necessary.

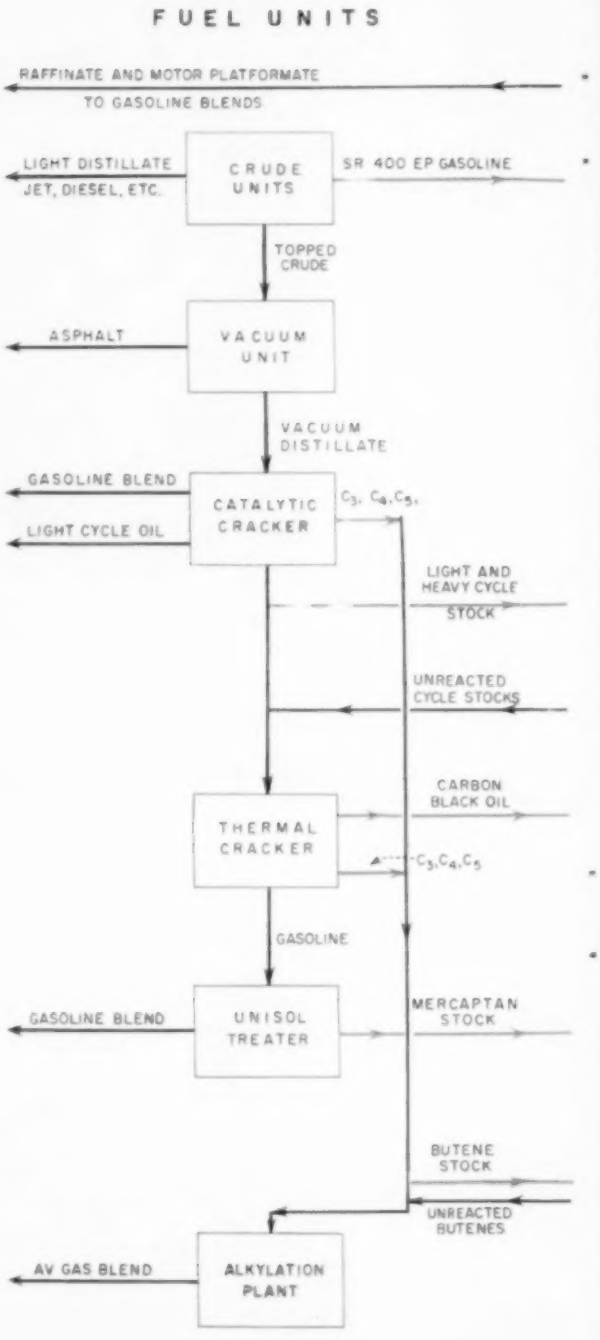
It was felt that process flexibility would lead to greater adaptability to changing markets as well as to greater product diversification.

Such conventional diversifications as asphalt and LPG were inaugurated in order to realize maximum dollar recovery from crude.

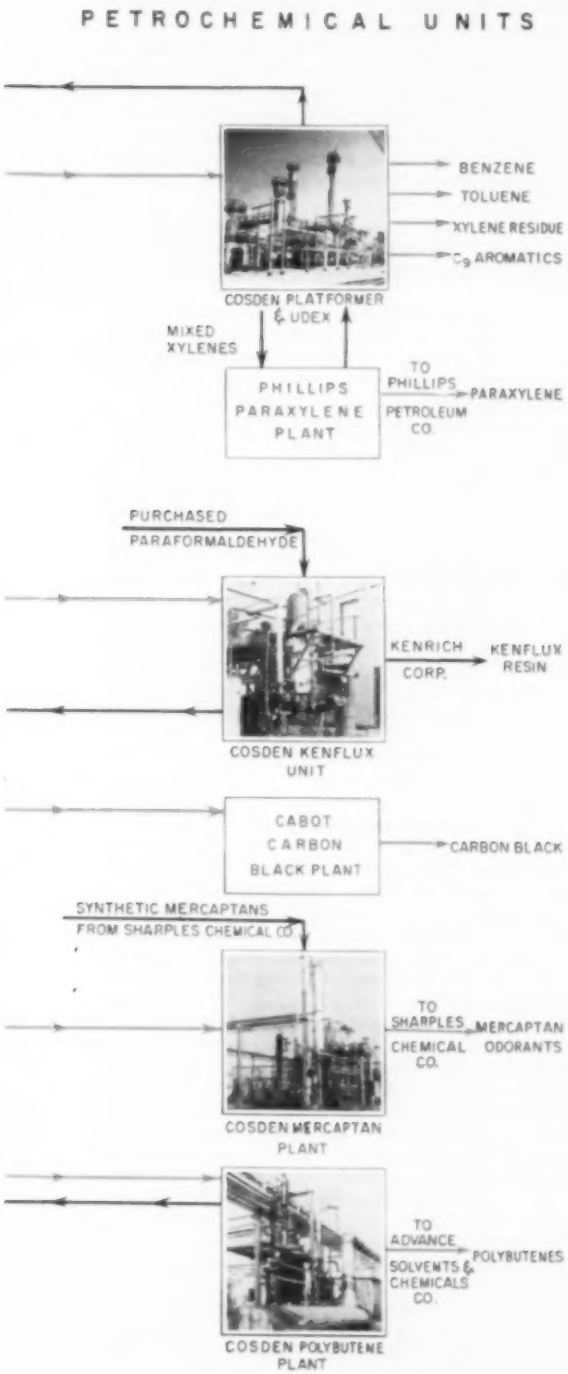
Cresylic Acid

Insufficient capital prevented the purchase of an existing chemical company or the establishment of a well staffed subsidiary; consequently Cosden decided to enter chemical operations rather cautiously.

Late in 1946, an experimental program was instituted to investigate the possibility of the recovery and sale of by-product chemicals from refinery waste. The first such oper-



to Petrochemicals



ation was the recovery of cresylic acid from spent caustic soda.

Slightly over $8,000 was invested in a little plant held together mainly by chewing gum and bailing wire for the recovery of cresylic acid.

This very small operation not only paid its own way, but also produced sufficient revenue for further experimental work, and even produced a nominal profit.

Operation was eminently simple. Spent caustic soda from the treating of cracked gasoline was passed counter-currently through a small packed tower wherein the soda was neutralized by waste hydrogen sulfide gas. Some refinery gases would do just as well.

The spent caustic emerging from this tower was allowed to settle and a cresylic acid concentrate separated to the top.

Concentrate was then distilled in a small fractionating column—possibly made from 12-in. pipe—and the distillate acids were sold into the chemical market.

Mercaptan

Another available by-product, mercaptans, was available in a very crude form from the Unisol treater.

These mercaptans had previously been burned as boiler fuel.

It was known that mercaptans were widely used as additives for odorizing natural gas and LPG.

A brief market study was made and the decision reached that it would be more profitable to produce specification odorants for marketing by an already established company rather than for Cosden to enter directly into the sale of these products. That is, we would do the processing and let somebody else sell the products.

The sale of gas odorants is something in the nature of a drugstore business, wherein relatively small volumes of materials are sold to numerous consumers. In each case, a great deal of specialized knowledge is required by the salesman.

The cost of building up such a specialized sales staff for a small volume of a single product could not be justified if it were possible to produce these mercaptans for sale by an already established marketer.

A process deal was made with the Sharples Chemical Co., one of the earliest producers of gas odorants in the United States, whereby Cosden would install necessary equipment for the recovery and distillation of mercaptans with specified boiling ranges.

Sharples arranged to ship to Cosden certain synthetic mercaptans which were made in their own plant. Cosden then undertook to blend the natural and the synthetic mercaptans to odorant specifications.

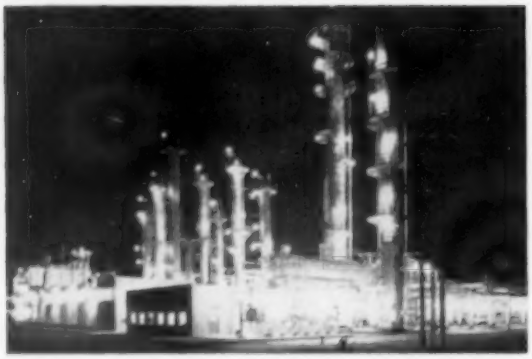
After blending, Cosden drummed, stenciled, and shipped the mercaptans directly to the customer as well as to warehouse storage at Sharples.

Although this operation was very small scale, it established the validity of the concept of making process deals with existing chemical companies.

In this way, Cosden was able to concentrate on processing alone and not on selling also, whereas the chemical company, already well established in its own field, was able to augment its supplies of material without committing capital.

The field of joint effort between small refiners and chemical companies has been neglected.

It is not necessary for the refiner to build a chemical distribution organization nor is it necessary for the chemical company to build its own raw material source. If each



BIGGEST PETROCHEMICAL OPERATION at Big Spring is the B-T-X aromatics facilities, shown in this night view

respects the problems of the other, a fair division of the profits can be negotiated. It makes sound sense that the two should join forces on any project which would result in mutual benefit.

Again this small scale operation produced only a relatively small profit, but again it did pay its way and helped pay other experimental costs on other projects.

Many of these other projects were complete failures. But even the failures served a useful purpose in that they enabled our personnel in Cosden to become better acquainted with personnel in chemical companies and to become more confident in negotiations dealing with chemical production.

Missed Opportunities

Unfamiliarity with the chemical markets led Cosden to pass up several projects which in the light of subsequent knowledge would have been quite profitable.

One such project was the production of elemental sulphur from waste hydrogen sulfide. The opportunity was lost to Cosden by the time it became apparent to everybody that such a process could be profitable.

Another such project several years ago was the recovery of aromatics by solvent extraction. This, too, was passed up because of lack of familiarity and confidence in the chemical market.

We mention these lost opportunities to emphasize the fact that they were lost not because of timidity about the manufacturing but because of timidity about the marketing.

It does not follow that an opportunity which is passed up is irretrievably lost. In the case of the aromatics project we actually did install a major chemical unit for the recovery of aromatics in recent years. We will have more to say about this later.

The practice and experience obtained in small by-product operations and chemical studies emphasized the fundamental truth that any logical product which can be derived from crude oil is well within the province of a refinery operation.

Management began to accept that there is no fundamental difference in making a decision on whether to produce asphalt, coke, lube oil, LPG, chemicals, or any other product which can be derived from our prime raw material.

Carbon Black Oil

The first really significant petroleum chemical development by Cosden was a product which fell somewhere between conventional refinery operations and petrochemical operations.

This was a special carbon black oil for use in a furnace type carbon black plant.

Somewhat pessimistic estimates of the future in residual oil markets led Cosden in 1949 to investigate the possibility of alternate uses for residual fuels.

During the period of investigation of this project, we learned that research, performed by a large producer of carbon black, indicated not only that superior blacks could be produced from a high-aromatic, residual-type fuel oil, but also that the overall economics could possibly be more favorable than in the case of a typical distillate type fuel.

A joint program was initiated to develop such a residual fuel.

Cosden was naturally quite interested in the project because at that time the principal customers for residual fuel oil were the railroads, which were rapidly converting to diesel power.

As a result of the joint research and experimental program, it was found that the most desirable carbon black fuel oil could be produced by thermally cracking selected feed stocks obtained from various units, especially the catalytic cracker and under specific process conditions.

It was further proven that superior carbon blacks could be produced with excellent yields in a specially designed carbon black furnace from this special oil.

A ten-year contract for the manufacture and sale of this special carbon black fuel was consummated in the latter part of 1950 and in March, 1951, a furnace type plant of fifty million pounds per year capacity was completed adjacent to Cosden's Big Spring Refinery by Cabot Carbon Co. We sold them the land and a couple of tanks that were on it, and built a fence and a pipe line. In operation, Cosden pumps the stuff to Cabot, and they make carbon black.

This carbon black plant represents a substantial investment in what might well be classified as a chemical operation utilizing a specially prepared raw material provided by Cosden.

Such interdependency requires that mutual confidence be high.

BTX Aromatics

The requirement for more gasoline and higher octanes led Cosden to investigate various new reforming operations.

The Platforming process looked like a good answer to the problem of obtaining a higher octane gasoline and, at the same time, the Udex process showed excellent possibilities for the recovery of aromatics known to be present in our streams.

Based on process expectations of the Platforming-Udex combination, preliminary economic studies indicated that the unusually high aromatic and naphthenic content of the raw material would offset the high inland freight differential existing against the price of the product produced in West Texas and sold in Midwestern and Eastern markets.

Because of the confidence and experience gained in previous smaller, though not wholly unrelated chemical ventures, it was decided to enter this new field of aromatics production.

The previously successful concept that a venture must be related to an existing chemical company was maintained, at least in part.

A five-year contract was obtained from one of the larger chemical companies and covered one-half of the anticipated production of benzene and xylene. This was done to support construction of the facilities.

However, since these aromatics were to be produced on a much larger scale than the previous specialty chemicals, and

were already familiar to us as sellers of solvents and specialties, it was decided that Cosden would enter the field of direct selling for these particular commodities.

This new and rather significant step does not mean that we intend to abandon our old policy of making process deals when such deals are more sensible. However, we felt that activity directly in the market would be beneficial to our experience and knowledge as well as to potential development of further fields of chemical diversification. Furthermore, the volume is enough to justify a sales staff.

The Udex extraction unit makes a type separation between the aromatic and non-aromatic portion of the feed with extremely high selectivity.

The non-aromatic portion of the whole extract does not exceed .2% by weight with overall aromatic recovery in excess of 96%.

The extract is clay treated for acid wash color and then fractionated in a series of three columns into specification benzene, toluene, and xylene.

Simultaneous production of the three aromatics in a simple fractionation step is possible only because of the extreme purity of the extract.

This installation at Cosden was the first installation of its kind. The usual separate treating and rerunning of each product has been eliminated in the Udex process.

The success of the design has been proven and several other large units have been built or are now under construction.

Polybutenes

The acquaintanceship obtained with one of the Eastern chemical companies—Advance Solvents & Chemicals Co.—through earlier development projects and discussions eventually led to the decision whereby Cosden would produce polybutenes for the account of Advance.

Polybutenes are high-viscosity, high-molecular weight polymers made predominantly from isobutylene.

The product itself is nothing new in the market but original work was required at Big Spring in order to adapt the process to the particular streams available.

These high viscosity polymers are used in pressure-sensitive adhesives, surface coatings, resin modifiers, asphalt specialities, and lubricating oil additives.

The process deal in this case involves sale of Cosden's entire production of several grades of polybutene to the "chemical company partner."

Paraxylene

Because of the availability of nearly seven million gallons a year of mixed xylenes the possibility of diversification into isomer separation became interesting.

The Phillips Petroleum Co. developed a new and revolutionary fractional crystallization process for the separation of paraxylene—primarily used today in Dacron fibers—from mixed xylenes.

Discussion between the Cosden and Phillips managements led to a decision for a joint venture. Cosden had the xylenes and Phillips had the process.

It was advantageous to locate the paraxylene plant at Big Spring because of several reasons:

1—The uncertainty of the step from pilot plant to commercial production made it difficult for Phillips to give a firm commitment for a specified amount of mixed xylenes.

2—Phillips was interested only in the paraxylene and did not desire to market the residual xylenes.

3—It was estimated that by locating the plant at Big Spring the freight saving alone would be equal to the plant investment in less than five years.

Phillips agreed to design and build a commercial paraxylene extraction unit on ground leased from Cosden and adjacent to Cosden's BTX plant.

Cosden agreed to operate and maintain the unit and sell the entire production of paraxylene to Phillips at a stipulated price.

Cosden's price to Phillips reflects the value of the mixed-xylene feed stocks plus an operating fee.

Phillips recovers its development cost and plant investment by the margin of profit from a still higher price.

Thus, in this case Cosden reverted to its previous policy of making process deals.

The first tank car of paraxylene was shipped from Big Spring in December, 1953. Plant production runs 98.7% purity which is considerably higher than the 95% purity available from other sources.

Paraxylene recovery closely approaching the theoretical is maintained, and the commercial success of the process is now assured.

Other Xylene Isomers

Studies are currently under way at Cosden for the possibility of recovery and use of the other xylene isomers.

These other xylene isomers can be converted into chemicals which are currently used widely in the plastics and synthetic fiber fields.

The requirements and uses of such new chemical building blocks are growing rapidly. Their separation, if economical, represents another form of diversification of end products from crude oil.

Meet the Authors

Mr. Krausse

Dan M. Krausse, manager of manufacturing, Cosden Petroleum Corp., Big Spring, Texas, was born in Houston in 1925, received his B.S. in chemical engineering from the University of Texas in 1947, and went to work for Sinclair Refining Co. in East Chicago, Ind., upon graduation. He joined Cosden in November, 1949, as control engineer, and became assistant to the president in 1952. Mr. Krausse is a member of Tau Beta Pi, Phi Eta Sigma, and Delta Tau Delta. He is active in Big Spring in the Rotary Club, Chamber of Commerce, Boy Scouts, and the Howard County United Fund. W. K. Jackson is also a native Texan. Born in 1915, he was reared in Central and South America and then returned to Texas to attend college. He was graduated from the Rice Institute in 1937 with a B.S. degree in chemical engineering. Following graduation, Mr. Jackson went to work for Shell Oil Co. in St. Louis and Wood River. In 1937, he joined Cosden as assistant chief engineer. In 1946 he was appointed director of research, and in 1952 director of the newly formed Chemical Division.

Mr. Jackson

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Safety in Petrochemical Plants

WHAT are the safety and fire protection problems in petrochemical processing? Are they the same or are they different from those in more conventional petroleum or chemical processing? What facts must the designer, the operator, the maintenance man, and the safety engineer know to overcome hazards in petrochemical manufacture?

For some practical down-to-earth know-how, your best bet would probably have been to attend the panel discussion on "Safety and Fire Protection in the Petrochemical Industry," during the 8th Mid-Year Meeting of the American Petroleum Institute's safety and fire protection committees in New Orleans about a month ago.

Failing that, it will pay to read this first-hand report on that meeting by PETROLEUM PROCESSING's Southwestern Editor, Dave Thornton.

Each of the four panel members at the New Orleans meeting first gave a general discussion of his assigned subject and then replied to questions from the floor. Dave's report is a digest of the entire session. E. G. Miller, head, safety dept., Esso Standard Oil Co., Baton Rouge, La., was the moderator. Panel members and their subjects were:

David P. Acaster, supt., acetylene plant, American Cyanamid Co., Avondale, La.: "Safety and Fire Hazards in Handling Acetylene."

James Hammond, toxicologist, Humble Oil & Refining Co., Houston, Texas: "Toxicological Studies for Plant Safety."

J. T. O'Brien, supt., high temperature operations, Esso Standard Oil Co., Baton Rouge, La.: "Safety and Fire Protection in Petrochemical Plants—General Design Considerations."

H. L. Payton, supt., ammonia and ammonium nitrate manufacturing, Lion Oil Co., Luling, La.: "Safety in Ammonia Plants."

1—Design for safety before you build

Bring the safety engineer into both the design and the construction work. Safety considerations in designing layout and spacing of a new petrochemical plant or a new unit in an existing plant are equally as important as the process design itself. However, designers are frequently too involved with process requirements. They may overlook the problems of the men who will run the plant, repair and maintain it, or have to get away from it in the event of an emergency.

Plan for the safe movement of men, materials, and supplies. The clock house — and often locker rooms — should be located as centrally as is possible. This will minimize the time required for employes to get to and from their jobs, and it will reduce exposure to plant traffic hazards.

Place the principal warehouse for maintenance materials near a main plant entrance—not necessarily the employes' entrance—to minimize truck traffic through the plant. This is probably next in importance to employes' entrance, because it is likely to be the second largest generator of traffic. Where a plant is considerably "spread out," it may be desirable to have two or more warehouses, each serving designated areas, with materials deliveries appropriately routed.

An example of too much traffic through one area is in those plants which are so arranged that everything —employes, raw materials, and warehouse items—must all flow down a "main street." It would seem obvious that a minimum of in-plant travel should be sought.

Give street layout careful consideration. Often streets are so narrow that they complicate maintenance and safety unnecessarily. They should be adequately wide and as straight as possible to accommodate mobile maintenance equipment. They should separate adjacent process units so that, if serious trouble develops in one area, operations will not be imperiled in the adjoining one. Street arrangement for emergency access to all sides is a must for fire and disaster protection.

A good standard is that applied wherever possible by Esso Standard Oil Co.—provision of "blocks" 400 by 600 ft. for the location of units. Pipeways crossing streets are high enough to permit the maximum size of crane and similar equipment which is anticipated to be required in the area. Access on all sides is provided.

Don't overlook location of plant equipment with respect to plot boundaries. Units should be far enough away from their "neighbors" and the "outside" roadways so that operations will in no way affect neighboring operations. Conversely, arrangements should be such that no effects will be felt from operations that are close-by.

Plant powerhouse location is a corollary to this. It is usually most economic to place the powerhouse centrally. However, it should be separated sufficiently from operating units so that if the latter should be shut down for some reason, their troubles will not force a shutdown of the powerhouse too. Where there is no powerhouse, the same rules apply to a distribution center for purchased power.

It could be disastrous to have a fire in a unit adjacent the powerhouse or distribution center, for instance, which would force evacuation and shutdown of the boilers. It takes little imagination to see that this might well bring down the entire plant and/or rob the fire fighters of some facilities needed to help meet the emergency situation. Likewise, emergency shutdown of otherwise unaffected process units could conceivably increase the hazards at a time when there already is enough trouble.

Consider each individual process unit in relation to its own components and those of adjacent facilities. A petrochemical unit usually falls logically into one or more relatively narrow sections, or functions. These include compressors, pumps, fractionating columns, filters, and heaters, for example—each of which the designer should try to isolate from the others.

Maintenance as well as safety enters the picture in consideration of the arrangement of a unit and its components. Pumps, for instance, usually require the most frequent mechanical attention, with perhaps compressors next.

Shoot for "single-risk" areas for components as well as individual process units. If it is impossible to isolate the plant into a number of single-risk areas, it is at least desirable to attempt to out-guess the probable trouble spots. Then, when components or units go down for attention, there will be a minimum effect on the rest of the plant.

Pumps are a major trouble source in almost every plant. They are prone to leaks, and they require considerable preventive maintenance on a routine basis. Isolate them from other operating equipment. It is particularly imperative to keep them away from furnaces if the fluids handled are potentially flammable. Pumps handling especially hazardous fluids also should be isolated from all other pumps.

Control rooms should not be in the middle of an operating area, where access may be difficult in the event of trouble. Control rooms are the nerve centers of operating units. Place them at the edge of a process block and, if at all practical, in a direction upstream of the prevailing wind.

Plan for the handling of feed and product streams to and from the unit at the time the unit is being designed. Plan also for the handling of the material in process within the vessels. This is particularly appropriate in case of fire or explosion. After a unit has been built is a poor time to learn what should have been done. The best guide is previous operating experience.

Cooling towers should be well away from other equipment for two reasons: 1) to avoid spraying adjacent equipment with mist and carryover, and 2) to avoid undesirable effects on cooling efficiency. An important point to think about is the disposal of waste from units that are contaminated by process streams. This should be resolved as a design consideration for the unit which may provide the contamination. It is not a question to be handled after the contamination is found and disengagement must be provided for.

And in all cases, don't forget the possibility of future expansion. Provide for it when designing the original plant or unit.

Apply all these same considerations to existing facilities too. Each unit and its components should be analyzed for the elimination of undesirable features. Make a list of them and, when revamp time comes, a few may be changed. Try not to allow the $-sign to upset such plans.

Remove as soon as possible outmoded and unused equipment. This is the position Esso takes. There is not enough merit in the excuse, "it might be needed sometime," to permit it staying around cluttering up an operating unit. Here is a good rule to follow when a new service is planned for old equipment—a fractionator in an adjacent unit, for example. Move the equipment close to the projected point of use rather than installing means for transporting materials to and from it, even though this might at first appear rather expensive.

Set up a review committee with the job of bringing safety considerations into all plant design or revamp. The way Esso has done it, this group reviews all major equipment and units, and it has representatives from the process, safety, and mechanical departments. All proposed changes are reviewed while they are still in the early design stage and then approved by this committee. Decisions are arbitrated and usually backed up by top management.

The committee has prepared two aids: one is a set of rough block diagrams for considering overall units; the other is a guide table listing minimum safe distances between units and spacing of equipment of various types.

None of these aids, however, is a substitute for good sound judgment. That is provided for by selecting the men from a sufficiently high echelon in the management that their comments will be respected by all concerned, yet not so high that they have "lost touch" with what's going on in the plant.

Besides planning, this committee reviews all accidents and fires to determine causes. Frequently the cause is found to be ignorance or the "take-a-chance" type of employe; however, it may have been due to poorly written start-up or shutdown procedures.

Incomplete procedures were one of the early troubles at Esso's Baton Rouge plant, and they still crop up from time to time. A common trouble is that existing procedures become obsolete. A good way to keep them current is for the committee to review them periodically—every 18 months to two years, or as changes are made in a unit. The operating supervisor is present during the review and may be asked to justify any part of the procedure. Although the committee finds some errors, the supervisor usually finds them himself in trying to justify them. Operating procedures without unnecessary tasks not only prevent accidents for this reason, but operators will be less likely to "skip" something they themselves think unimportant.

At the start, Esso's committee found difficulty in getting projects to work on. But the results have paid for the missionary work through the years. Today, the group has difficulty staying abreast of all projects submitted, and it has had to create a project-screening subcommittee, capable of handling many problems without referral to the full committee.

2—Study the toxic materials you'll use

Toxicology applied to a specific plant is rather new. In the past, this has generally been left up to the medical staff, which may or may not be well-equipped to deal with the problem of industrial poisons. The oil industry may perhaps have been less concerned with toxicology and its implications than has the chemical and petrochemical industry. Crude oil and gas are in themselves relatively low in toxicity.

There are five axioms to follow in connection with toxicological hazards:

1—The worker can do little to protect himself unless, and until, the employer has done everything possible to eliminate or mitigate toxicological hazards.

2—Control will never be completely successful unless the hazard can be controlled by methods *external* to the employe.

3—Practically all industrial poisons are inhaled.

4—No vapor or gas can be safely ignored. None is so toxic that it cannot be used in industry.

5—The employer should thoroughly familiarize all personnel with the hazards from materials with which they

may come in contact, and what to do if exposed.

Elaborating on the second axiom for example: Assume that a process is involved for which it has been specified that all operating (and perhaps maintenance) personnel must wear respirators to be entirely safe. After a while, some employe forgets to use the respirator and may not get hurt at that time. He then decides protection isn't necessary, and fails to use it from that time on except when the boss is looking. Or, he may not have been instructed properly in its use, and therefore goes on using it, but incorrectly.

In either case, an employe eventually gets hurt. This is *not* protection external to the employe, but rather it is something he must do to protect himself.

On the other hand, suppose the process is entirely enclosed. Thus, no protective equipment of any kind is required for the operating personnel. In that case, an employe cannot get hurt for lack of or for improper use of protective equipment. This is the only real way to get toxicological hazards out of a unit—engineer them out.

Protective efforts may literally be fumbling in the dark unless the behavior characteristics of a material under the particular physical conditions in which it is handled are known. Such characteristics include: vapor pressure at environmental conditions, specific gravity, boiling point, melting point, and flash point.

Toxicological characteristics may be broken down into these five groups:

1—Irritants: examples are hydrogen sulfide, acids, alkalies, ammonia.

2—Asphyxiants: suffocation is produced by hydrogen, nitrogen, and carbon dioxide. Carbon monoxide, acrylonitrile, and hydrogen cyanide are examples of those which inhibit utilization of oxygen in body cells.

3—Volatile organic systemic poisons: these usually affect other organs than lungs or skin. Benzene affects the bone marrow: methanol causes blindness: terpenes affect the bladder (bloody urine); and carbon tetrachloride damages the liver.

4—Volatile metallo-organic systemic poisons: nickel carbonyl is deadly (0.01 ppm. is too much and accumulative effects are notable in chronic exposures). Benzene and tetraethyl lead are in the same accumulative category.

5—Volatile inorganic systemic poisons: best example is mercury.

The preceding groups include materials with known cancer-producing factors and others having delayed effects, discernible only after years of exposure—like coal tars, silicon compounds, and other dusts.

Lists are available of hazardous materials and their safe limits of exposure from a number of sources. These include the U. S. Department of Health and Welfare, the American Petroleum Institute Toxicological Reviews,[1] the Manufacturing Chemists Association's Safety Data Sheets and its suggested data for warning labels. Books often contain errors, however, and their accuracy should be checked by users.

A common trouble in using lists of exposure limits, however, is that the user may not realize such data are by no means static. Data are constantly being revised in the light of new information. Meager or inadequate information previously available may have led to the conclusion that a specific exposure was "safe." Later information may warrant revising the exposure limit downward. Consequently, the user should insist on current listings.

A help to all would be for producers and users of hazardous materials to report precise effects of exposures with an accurate description of the conditions under which they occurred. One of the great difficulties the toxicologist encounters is in measuring the amount of material which may be involved.

The best way to sample the environment is with the worker himself. If the presence of the hazardous material can be measured in body excreta, then an eight-hour sample is available for evaluation. About 30 materials are now known in this category, including such heavy metals as mercury and its salts.

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[1]See also:
"How to Handle Chemicals Safely," by V. B. Guthrie, PETROLEUM PROCESSING, August, 1954, pp. 1203-4.
"Toxic Properties of Refining Chemicals Listed by API Medical Committee," PETROLEUM PROCESSING, Oct., 1948, p. 969.
"API Medical Group Presents Study of 18 Toxic Refining Chemicals," PETROLEUM PROCESSING, Oct., 1949, p. 1094.

—Factors in acetylene processing

Acetylene is particularly hazardous to handle because of its tendency to decompose violently under pressure, and the particularly wide explosive range — from 12.5 to 80 vol.-%. Above 20.6 psia., special precautions must be taken.

Some good tips on safe practices can be gained from procedures followed in acetylene manufacture. The American Cyanamid plant at Fortier, La., uses the Sachse process, based on the partial oxidation of methane with pure oxygen in burners of special design, producing an effluent gas containing about 8% acetylene. This is cooled and filtered, then compressed, and finally absorbed in a selective solvent. Acetylene is recovered from the absorbent by a temperature and pressure flash, after which the solvent is cleaned up and returned to the process.

For reasons of safety as well as the advantages of a continuous process, this is a highly instrumented plant. For example, control rooms are pressurized to prevent leaks into them. All process streams are heavily monitored with alarms and shutdown devices. Continuous stream analyzers are used (see the article, "Control by Continuous Infrared Analysis," in PETROLEUM PROCESSING for May, 1955, page 710).

To avoid decomposition under pressure of the high-purity acetylene product, seals of the continuous water-flow type are used extensively to keep stream pressures below about 17.6 psia. Special maintenance is given this equipment. It does not vent through the emergency blow-down header system, but rather to stacks equipped with a pilot flame and continually purged with nitrogen. Where gas is vented constantly, arrangements are made to send it to the boiler house for fuel or to get the heat value out of it in some other way.

Storage is at pressures below 17.6 psia. wherever possible. During handling, it is always assumed that any vessel or the contents of a line are within the explosive range. Anything could happen if a spark occurs when the pressure exceeds 20.6 psia., so equipment is designed to eliminate this possibility.

Multiple small tubes inside of pipe are used to transfer acetylene under pressure, for instance. Experience has shown that it can detonate in any line

over 1-in. I.D., so transfer lines exceeding this size are crammed full of 0.25 to 0.5 in. I.D. tubing. Elbows in large lines are packed with Raschig rings, and special valves are used.

The theory behind this practice is quickly to conduct heat away from decomposing acetylene. Effectively the same thing is done when acetylene is confined in cylinders under pressure: the material being isolated in small pockets to minimize the possibility of detonation.

Sparks must be kept away when vessels which have contained acetylene are to be opened: it is always assumed that the contents are within the explosive limits. The vessel is well-purged with nitrogen—readily available in the plant as a by-product from the liquid oxygen plant—and followed by an air blow. An air-sufficiency test is also made before men are permitted to enter the vessel.

4—Safe practices in ammonia plants

A conventional plant for the manufacture of ammonia and ammonium nitrate from natural gas and air has fire, safety, and toxicological hazards.

The process involves the thermal cracking of methane by controlled oxidation to produce hydrogen and carbon monoxide, the gas-shift synthesis with steam to convert the carbon monoxide to carbon dioxide with evolution of more hydrogen, removing impurities from the charge gases, and the catalytic combination of hydrogen and nitrogen into ammonia under 5000 psi. pressure.

Failures in the plant usually are by unit rather than individual equipment item failures. Accidents are very frequent and usually involve traumatic injuries rather than fire or poisoning. Hydrogen, however, is highly inflammable and the explosive limits with air lie between 4 and 27%.

Chemical hazards are many. Carbon monoxide is very toxic and gives little or no warning of its presence. Every effort is made to keep it confined. The copper solution used to remove final traces of CO from charge gases likewise is poisonous and very irritating to the skin and eyes. It also is corrosive.

Ammonia leaks usually are easily detected because of the characteristic odor and the white cloud formed on contact with chlorine gases. The gas will burn the skin and eyes and gives rise to convulsive coughing when inhaled. The liquid will produce painful skin burns, total and permanent blindness if it gets in the eyes. The material is very corrosive to many alloys, particularly those containing copper, plus some of aluminum; it will damage galvanized surfaces.

Safety showers are provided where men are apt to come in contact with ammonia or nitric acid, treating solutions and the like. All have a hose connection for use in washing eyes. Respirators and masks are available also.

Carbon dioxide is not poisonous and uninflammable but can cause asphyxiation. Being much heavier than air, it can settle in low places; air sufficiency tests are suggested where its presence is suspected.

Fires are a serious matter, considering the presence of large quantities of hydrogen in an ammonia plant; carbon monoxide also is inflammable under certain conditions. The best preventive is good housekeeping and vapor-proof lighting fixtures.

Principal safety practice in maintenance is to purge and blind all tanks and lines. Valves are never depended upon to block lines. Explosives mixture and air sufficiency tests are made of all vessels before men are allowed to enter.

In plant design, it is the practice to vent all relief valves and packing glands to a stack. Surprisingly enough, there has been no evidence of hydrogen blistering, either in the ammonia plant at El Dorado, Ark., or the new Barton plant.

Do You Know These Words?

By B. H. WEIL
Manager, Information Services
Ethyl Corp. Res. & Engrg. Dept.
Detroit, Mich.

A regular department intended to help administrators and operating men alike keep abreast of technical names and processes in the petrochemical field.

Carbon Dioxide

Carbon dioxide, pronounced **"kahr**-bohn dye-**ahk**-side," is used commercially as a gas, a liquid, and a solid (the familiar "dry ice"). As a consequence of the growing emphasis on ammonia production from petroleum and/or natural gas, it (as a by-product) has become a high-tonnage petrochemical. As a gas, and as a liquid, it is colorless and odorless; as a solid, it is white. It has the formula CO_2 (one atom of carbon, two atoms of oxygen), and is an ultimate end product of the combustion or decomposition of carbon or carbon-containing materials, be they gasoline, wood, or parts of the human body.

Carbon dioxide finds use in the refrigeration of foods and other perishables (as dry ice), in the carbonation of beverages (in all three forms, but with the use of dry ice growing), in industrial refrigeration, as a raw material for the manufacture of a host of chemicals (including those used in aspirin, baking powders, plastics, soaps, and glass), in fire extinguishers, etc. Some of these uses are vulnerable to competition from other methods (mechanical refrigeration, for example).

Methods of manufacture are varied—from coal or coke, as a by-product of fermentation, from limestone, from natural wells, from phosphates, etc. By far the greatest quantities are now being produced from natural gas and/or petroleum, however, either deliberately or as a by-product from ammonia production. In the latter instance, it is scrubbed or otherwise removed from the gases formed in the production of hydrogen either by the partial combustion (reaction with oxygen) of natural gas or petroleum fractions, or by the reaction of either of these materials with steam. In both instances, carbon monoxide (CO) is formed first and is converted to CO_2

(*Continued on the following page*)

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by reaction with steam (H_2O)—a process which yields even more of the desired hydrogen (H_2).

Production of carbon dioxide is approaching a million tons a year. Accordingly, this material has become one of the few really large-tonnage inorganic chemicals produced from petroleum.

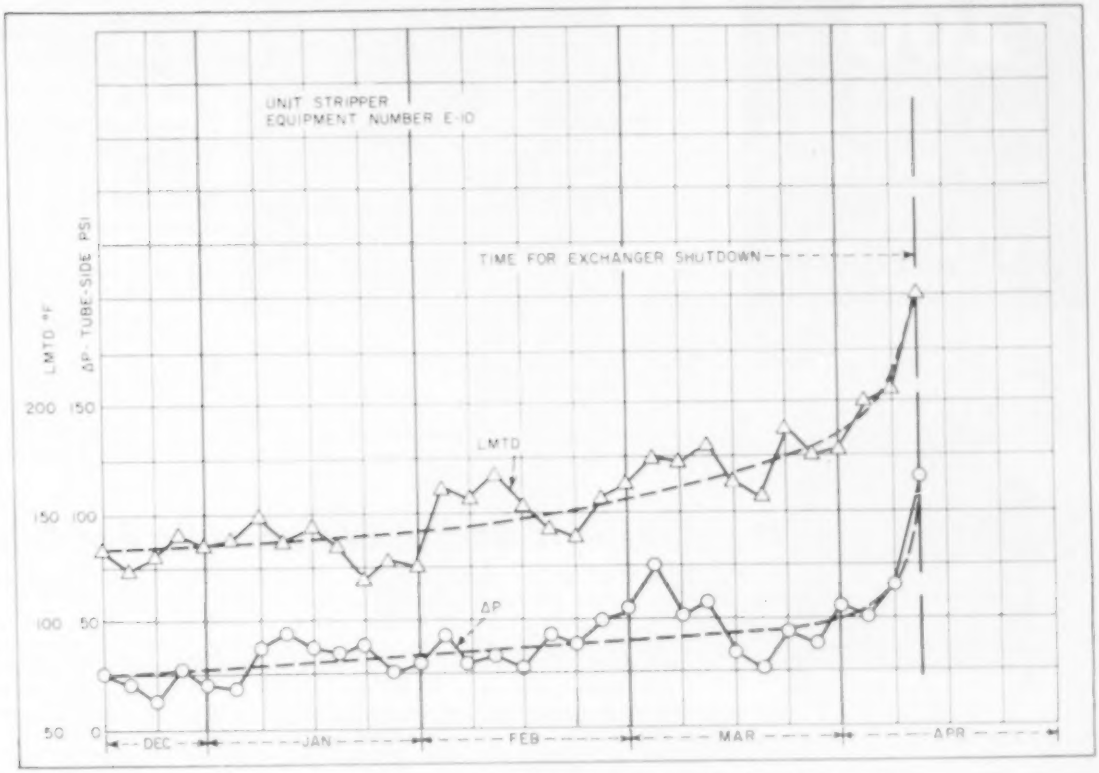
Caprolactam

Caprolactam, pronounced "**kah**-pro-**lack**-tam," is a petrochemical which really demonstrates the versatility of the chemical industry—how one type of chemical product (nylon) can be made in two completely different ways. It has the formula $C_6H_{11}ON$ (in the shape of a ring, with both ends of the carbon chain attached to the nitrogen atom), and is a solid which melts at well above room temperature.

Caprolactam became of major interest last year with the expiration of certain basic "product" patents covering such "condensation polymers" as nylon. While the original manufacturer still holds a strong patent position on its own method of manufacturing nylon—"nylon 66," produced by condensation - polymerization of adipic acid (a 6-carbon chemical) with hexamethylene diamine (also a 6-carbon chemical)—industry has long known that competitive products (synthetic fibers and plastics) can also be made from the polymerization of a single 6-carbon chemical, caprolactam. Indeed, such products have been and are being produced in Germany under the name of "Perlon." Accordingly, several companies have entered the "nylon 6" field, and at least one is producing caprolactam in large quantities.

As a petrochemical, caprolactam is producible by a series of reactions from phenol, hydrogen, and hydroxylamine (itself produced from ammonia). In turn, phenol is produced from benzene (derivable from the catalytic reforming of naphtha), hydrogen may be produced from natural gas or petroleum fractions, and ammonia itself may be produced from petrochemical hydrogen.

At the moment, the future of caprolactam is intimately tied up with that of "nylon 6" fibers and plastics. Such fibers are said to dye faster and with truer shades than "nylon 66," to resist abrasion better, to be softer, and to yield less clammy fabrics. The plastics are said to be at least competitive, including price-wise. It would thus seem that "nylon 6" and its raw material, caprolactam, face a really interesting industrial future.



RISING VALUES OF LMTD AND ΔP indicate time for exchanger shutdown due to fouling

Graph Schedules Exchanger Shutdowns

OPERATIONS engineers at Socony-Vacuum Oil Co.'s East Chicago, Ind., refinery have reduced the number of time-consuming heat balances they must make to check a heat exchanger's performance.

Instead of several heat balances on a single item of equipment during its on-stream life, they plot frequent LMTD-ΔP values on a graph to inform them of excessive fouling and the need for a shutdown and cleaning.

The graphical plot—shown above—of log - mean - temperature - difference (LMTD) and tube-side pressure drop (ΔP) is kept for each critical piece of heat exchange equipment using data from the daily operating log.

The method is not used for all heat exchange equipment, but only for reboilers handling unstable gasolines and heat exchangers transferring heat to cold crude from hot gas oil or residual streams — situations particularly prone to rapid internal fouling.

Increased tube-side fouling results in increased tube-side pressure drops and increased exchanger LMTD values. When LMTD and ΔP values consistently equal or exceed a preset maximum value—unique for each exchanger in its own service—or show a sharp continued increase, Socony engineers know that the exchanger is ready for cleaning.

The constant dips and rises in the typical LMTD-ΔP graph shown above are the result of constant small changes in operating temperatures, pressures, flow rates, and product quality. However, it will be noted that the overall trends—shown by dash-lines—for both LMTD and ΔP are upward, and these trends, not just instantaneous values, are carefully watched.

At present, Socony still makes a final check heat balance, but now that they are familiar with the graphical method, they have found it to be a dependable criterion for excessive exchanger fouling. Very seldom does the LMTD-ΔP graph give a false alarm. Thus, instead of several heat balances —each requiring the better part of a half-day for data collection and calculation—they need only one balance, possibly none.

Socony operations engineers admit that a much better graphical correlation could be obtained by including the other operating parameters—temperature, pressure, flow rate and product quality. However, to add more variables to the graph would be so time-consuming as to negate the speed and simplicity inherent in their present method.

More Plant Practice Tips on page 882 ► ► ►

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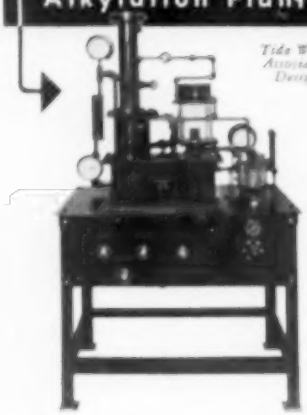

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A sulfuric acid alkylation plant can save as much as $200 a day on acid. This has been proved by performance with Tide Water Acid Analyzer, licensed by Hallikainen.

By a continuous measurement of the acid strength in the reactor, sulfuric acid in use and in the reject can be held at a minimum.

The trend of an acid strength in the reactor is apparent to the operator by reading the hydrometer, which has about a 10-minute process lag. Control of the acid in both the reactor and the reject permits even closer control of acid usage.

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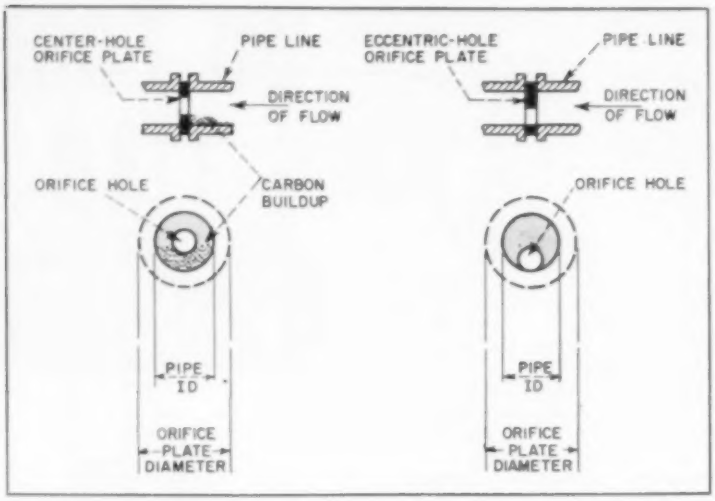

SOLIDS BUILD UP behind center-hole orifice plate, but pass eccentric-hole plate

Eccentric Orifice Ends Erratic Reading

ERRATICALLY decreasing flow readings had been noticed from the orifice meter in a high viscosity fuel line at Esso Standard Oil Co.'s Bayway refinery, Linden, N. J.

The liquid being measured has a viscosity of roughly 400 SSF at 275° F. and contains carbon particles. After about three week's operation, these carbon particles would build up behind the conventional orifice plate, actually covering a portion of the orifice hole, and change the flow characteristics of the liquid at the orifice plate.

Attempts to correct this situation by using rotameters failed due to a solids build-up on the float, and propeller meters failed due to clogging of the vanes.

A solution to the problem is an eccentric orifice plate with the bottom of the orifice hole flush with the bottom ID of the pipeline. This allows solids to flush through constantly and gives consistent flow readings.

Calculation of the discharge coefficients for the eccentric orifice plate is slightly different than for a conventional center-hole plate, and is made in accordance with "Flow Measurement with Orifice Meters" by Stearns, Jackson, Johnson, and Larson, published by D. Van Nostrand Co., Inc., New York, N. Y.

Alloy Cladding Ends Cooling-Corrosion

REACTORS and other high-temperature vessels tend to corrode internally in areas adjacent to externally welded structural supports and manways. This corrosion apparently results from the external member acting as a localized cooling fin for the vessel shell.

The Pure Oil Refinery at Lemont, Ill., has eliminated this localized "cooling-corrosion" by internal cladding. The appropriate stainless or alloy sheet is welded tightly over the corrosion-prone area.

For small areas of only one or two square feet, a single piece of alloy sheet is used. When larger areas are involved, strip-lining is used with 4-in. strips of the proper length lap-welded in place.

Manway nozzle internal areas, and vessel shell areas adjacent to the nozzles are also subject to "cooling-corrosion." Small nozzles are lined by bending an alloy sheet into a cylindrical shape and fitting it into the nozzle, flush with the manway cover.

A number of small holes are drilled through the alloy sheet to allow spot welding onto the nozzle. The seam in the sheet is also welded closed with a continuous bead.

To protect the inside of the vessel adjacent to the manway, the alloy sheet in the nozzle is lapped onto the vessel wall so as to cover the required vessel area, then welded into place.

Nozzles that are larger than 12 or 14 in. are strip-lined with 4-in. alloy strips.

ECONOMY
High-alloy layer—usually 10% or 20% of total plate thickness—assures corrosion and abrasion resistance, long equipment life.

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Integral bond allows design and fabrication of shapes to meet process and space needs.

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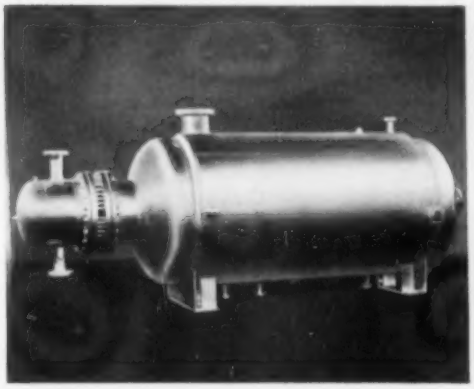
Low-cost carbon steel backing provides necessary strength and rigidity.

Nickel-clad steel gives this jacketed heating unit high corrosion resistance in processing light hydrocarbons and dilute hydrochloric acid.



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When new equipment is being planned, economical clad steels will assure maximum design freedom for your tanks and pressure vessels. Because of the integral bond between high-alloy cladding and the carbon steel backing plate, full gage consideration is permissible under the API-ASME Code. Clad can be readily worked by conventional fabricating tools and methods, permits easy and economical field erection. In service, clad steel helps protect against unscheduled shut downs stemming from seepage or crevice corrosion.

Clad steels offer you all the corrosion resistance of solid, high-alloy construction with savings up to 50% in material costs. These and other benefits, easy cleaning, drainage inspection or modification, can be obtained from 16 cladding materials—various types of stainless, nickel, Inconel, Monel, copper.

These are supplied with a standard sodium hydride finish, or may be polished to help improve performance characteristics. When you're thinking of new tanks and vessels, qualified equipment builders can help your engineers and consultants take advantage of versatile Lukens' Clad Steels. We work closely with fabricators to help select the type most suited to your processing needs. To get more information, ask one of your equipment builders, or write Manager, Marketing Service, Lukens Steel Company, 752 Lukens Building, Coatesville, Pennsylvania.

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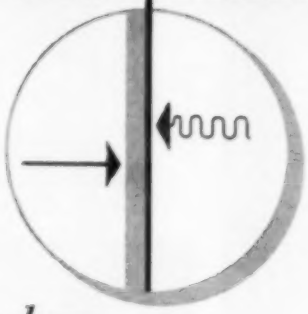
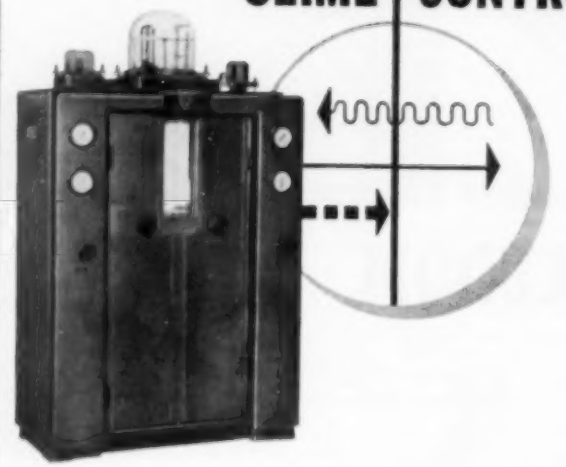


Be sure you have

SLIME | CONTROL



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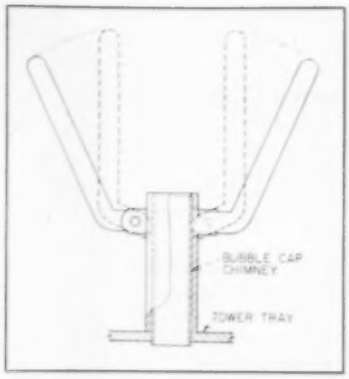

JIG POSITIONS BUBBLE CAP CHIMNEY in tower tray prior to rolling operation

Rolling Jig Speeds Installing Bubble Cap Chimneys

A JIG to speed installation of bubble cap chimneys in tower trays has been developed at the Marcus Hook, Penna., refinery of the Sun Oil Co.

The chimney is inserted through the hole in the tube sheet and held in position until rolled or expanded to achieve a snug fit.

This was formerly accomplished by tack welding the chimney to the under side of the tube sheet. The operation required a man to work in a tedious position with poor ventilation.

The clamping jig—shown above—completes the operation with one man working above the tube sheet. The device engages the chimney and holds it at the proper distance above the tube sheet while the arms of the clamp bear against the adjacent chimney and resist the rotation produced by the rolling operation.

This action of the jig eliminates the need for a man to do the tack welding.

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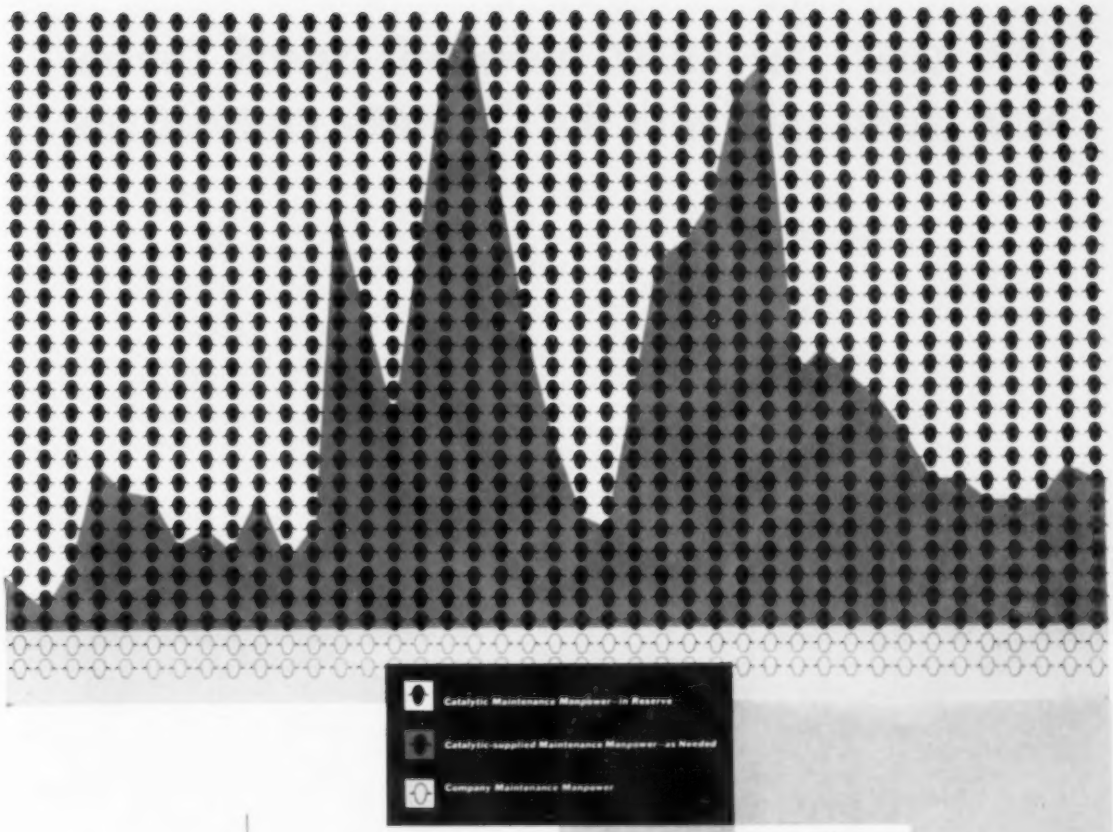

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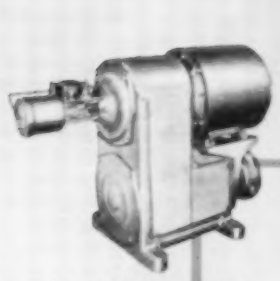
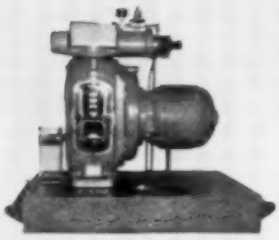
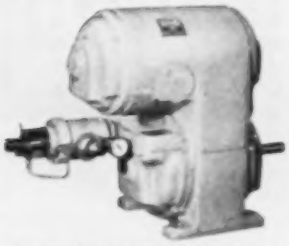


Reeves Vari-Speed Motodrive actuated by Cylinder Conomotor with external positioner.



Link Belt P.I.V. variable speed drive with Cylinder Conomotor.



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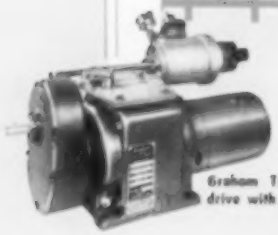

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E. Duer Reeves, executive vice-president of Esso Research and Engineering Co., has been appointed president of the Industrial Research Institute. The IRI represents 140 of the leading industrial research organizations and was formed to improve methods of research administration and organization.

Reeves has been Esso's executive vice-president since 1949.

David P. Parker is the new manager of the Brooklyn refinery of Socony Mobil Oil Co., formerly Socony-Vacuum Oil Co. He succeeds **William L. Linton,** manager of the refinery since 1938 and now retiring after 35 years of service.

Parker has been with the company since 1934, when he was graduated from Oklahoma A. & M. College with a M.S. degree. He became manager of the technical engineering div. at East St. Louis in 1947 and three years later was assigned to the British affiliate, Vacuum Oil Co. He served as manager during the construction and initial operations of the new refinery at Coryton, England, until the middle of 1954.

Jack A. Horner, secretary of Shell Oil Co., has been appointed vice-president in charge of the licensing div. of Shell Development Co. Horner retains his post with the parent company in addition to his new assignment. Horner has been with Shell for 18 years, its secretary since 1953.

John D. Long, research and design engineer of the Creole Petroleum Corp., has been promoted to the head of the manufacturing group in the company's headquarters in New York.

Mr. Long

Long was employed in 1936 by Standard Oil Development Co. as a process design engineer in the Bayway refinery. He joined Creole in 1945 as a technical assistant to the refining manager in Venezuela. From Venezuela he was transferred to New York in 1949 as a technical assistant to Lloyd G. Smith, Creole vice-president.

Long obtained his B.S. from Franklin and Marshall College, a M.S. from Lehigh University. His Ph.D. was awarded in 1932 by Pennsylvania State College.

Two Refiners Honored by API

Mr. Baldschwieler

Mr. Miller

OUTSTANDING service to the American Petroleum Institute Division of Refining was recognized by presentation of "certificates of appreciation" to **E. L. Baldschwieler** and **A. E. Miller** during the mid-year meeting last month in St. Louis.

Baldschwieler is a native of Switzerland, where he attended primary and secondary schools. He came to the United States in 1907 and attended Cooper Union in New York City, receiving the degrees of Bachelor in Chemistry in 1913 and Bachelor in Science (mechanical engineering) in 1920. During his studies for his second degree Baldschwieler became asst. chief chemist for the International Nickel Co. He gave up this job in 1922 and joined what was then the development dept. of Standard Oil Co. (N. J.) as an analytical chemist. He rose in the company, now the Esso Research and Engineering Co., until he became director of the analytical laboratories at the Linden, N. J., research center. He recently retired from the company.

Miller was graduated from Pennsylvania State College in 1912 with a B.S. degree in chemistry. He joined Gulf Refining Co.'s Port Arthur refinery as a chemist on experimental and process development and assisted in the development of the aluminum chloride process. Later he became asst. superintendent of the paraffin plant. He moved to the Chicago operations of the Sinclair Refining Co. in 1918, where he remained until 1921 when he was transferred to Europe for three years. On his return to the U. S. he was assigned to the company's New York headquarters. Miller rose in the company to the post of assistant to the vice-president of research and development and retired early in 1955.

T. R. Miller has become director of the South Charleston plant laboratories of the Carbide and Carbon Chemicals Co. Miller joined the company in 1940 after completing work for his Ph.D. in chemistry at the University of Pennsylvania.

T. B. Moore and **Maxwell Hill, Jr.,** have been appointed asst. superintendents at the South Charleston plant. Moore has become asst. superintendent of the shipping, order, and traffic depts. Hill replaces Moore in charge of fine chemicals and the Lower Blaine Island area.

Conrad E. Holben has been appointed an administrative assistant to the manager of production of Columbia-Southern Chemical Corp., a petrochemical subsidiary of Pittsburgh Plate Glass Co. Holben was formerly technical assistant to the works manager of the Barberton, Ohio, plant, the company's principal chemical producing plant.

J. E. Roth, vice-president and general manager, central div., of Tide Water Associated Oil Co., has been elected to the board of directors of the American Petroleum Institute. He replaces **E. H. Salrin,** retired vice-president of Tide Water.

L. C. Kemp, Jr., has been appointed general manager of The Texas Co.'s newly established petrochemical dept. The department will administer and coordinate the company's petrochemical activities. Kemp holds a degree in chemical engineering from Rice Institute and joined Texaco in 1929 as a research chemical engineer at the Port Arthur refinery.

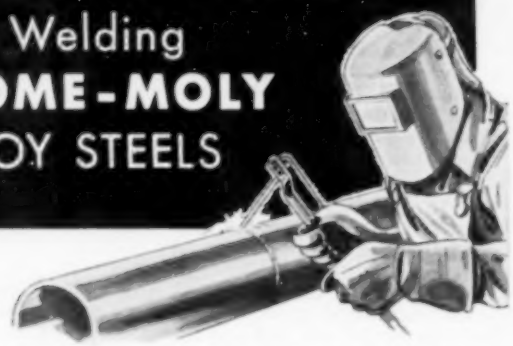
Mr. Kemp

He has held various managerial posts in the research field and was director of research for Texaco from 1941 until 1953.

J. B. Rogerson, formerly manager of manufacturing for Lion Oil Co., has been elected vice-president of manufacturing by the board of directors. Also, the director of research,

CHAMPION
PIONEERS AGAIN —

in Making Available
NEW ELECTRODES
for Welding
CHROME-MOLY
ALLOY STEELS



Champion now brings to the fabricator of Chrome-Moly Steels a new type of low hydrogen electrode of the AWS xx15 type, excellent for all position welding.

Champion's Croloy Electrodes produce a weld deposit with a carefully controlled composition which almost completely eliminates weld cracking and greatly reduces the preheat necessary as well as relieving the necessity of maintenance of preheat prior to stress relieving.

Champion Croloy Electrodes produce very smooth weld deposits in all positions and pass the most rigid X-ray requirements. Weld deposits from Croloy Electrodes possess very high ductility, 20-26% in the as-welded condition, and 24-30% stress relieved at 1350°F, as well as show stress-to-rupture properties equal to or exceeding that of the plate material. Champion Croloy Electrodes 3/32" through 3/16" diameters are available in grades for welding .5% Cr, .5% Mo through 5% Cr, .5% Mo material.

Complete technical data on Champion Croloy Electrodes will be furnished upon your letterhead request. Write Now! Dept. PR

THE CHAMPION
RIVET COMPANY
CLEVELAND 5, OHIO — EAST CHICAGO, INDIANA

Personals

R. C. Tallman, was elected vice-president of research.

S. A. Swensrud, chairman of Gulf Oil Corp., has been elected a director of Goodrich-Gulf Chemicals, Inc., a petrochemical subsidiary jointly owned by Gulf and the B. F. Goodrich Co. He was named chairman of the Goodrich-Gulf board.

P. W. Cornell, a director of the company since 1953 has been elected vice-president in charge of operations, engineering and development. He has resigned his former post of asst. manager of Gulf Oil's chemical dept.

Dan M. Krausse has been promoted to manager of manufacturing for Cosden Petroleum Corp. For the past three years he has been serving as an assistant to the president and general manager of the company.

Mr. Krausse

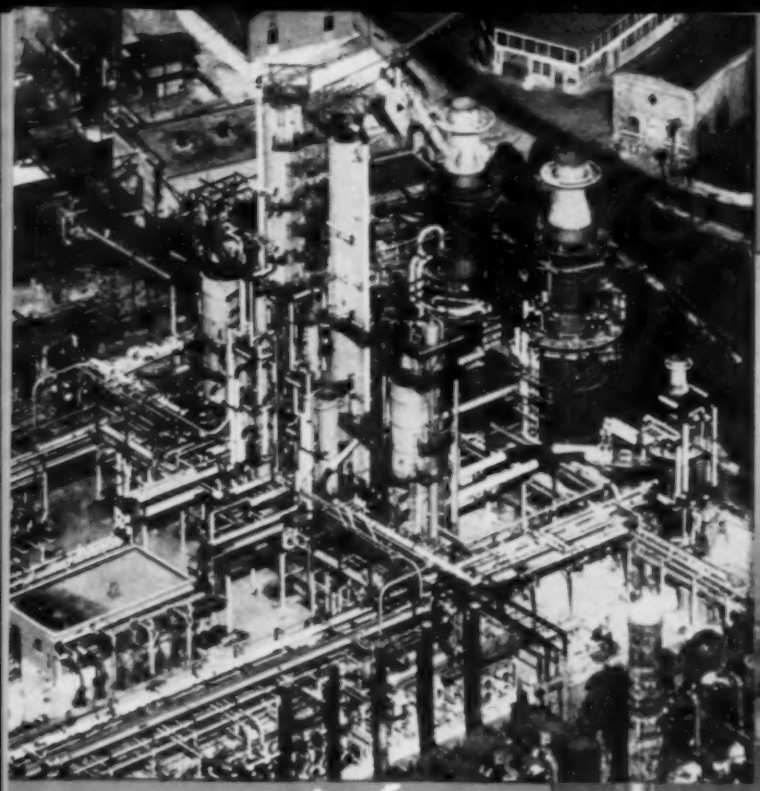
Krausse took his B.S. in chemical engineering at the University of Texas in 1947. He worked first with Sinclair Refining Co., and then joined Cosden in 1949.

L. O. Crockett has been appointed general manager of the Gulf Oil Corp.'s chemical dept., a new unit established to handle the company's expanding chemical activities. He will have as assistants **Alexander Lewis, Jr.,** who will manage chemical marketing, and **V. N. Hurd,** director of chemical development.

Crockett was previously manager of the petrochemical activities unit and also manager of the manufacturing dept.'s technical div. He began with Gulf in 1922 as a laboratory assistant in the Port Arthur refinery. Six years later he became a foreman of one of the processing units there and in 1934 was appointed chief chemist for all the Texas refineries.

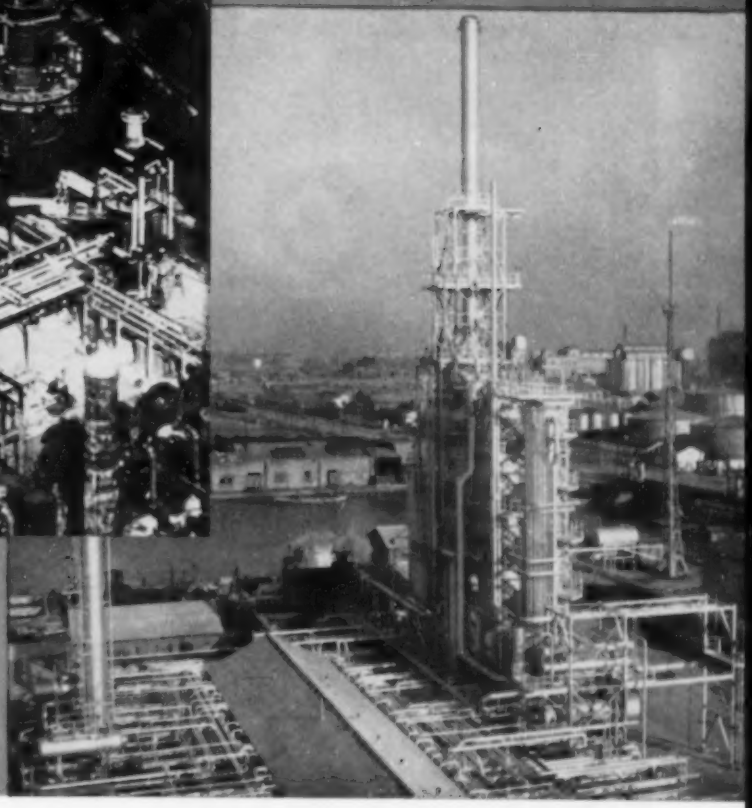
He was named asst. general superintendent of manufacturing operations in Texas in 1945. In 1950 he was transferred to the general office in Pittsburgh.

Dr. Lewis, a graduate of Ursinus College, joined Gulf in 1938 as an organic chemist in the refinery technology div. at Philadelphia. From 1946 to 1951 he worked for his Ph.D. at the University of Pittsburgh and was a staff member of the Gulf petroleum fellowship at the Mellon Institute. In 1951 he was appointed chief product engineer in the domestic mar-



RIGHT IN OUR OWN BACK YARD

OHIO



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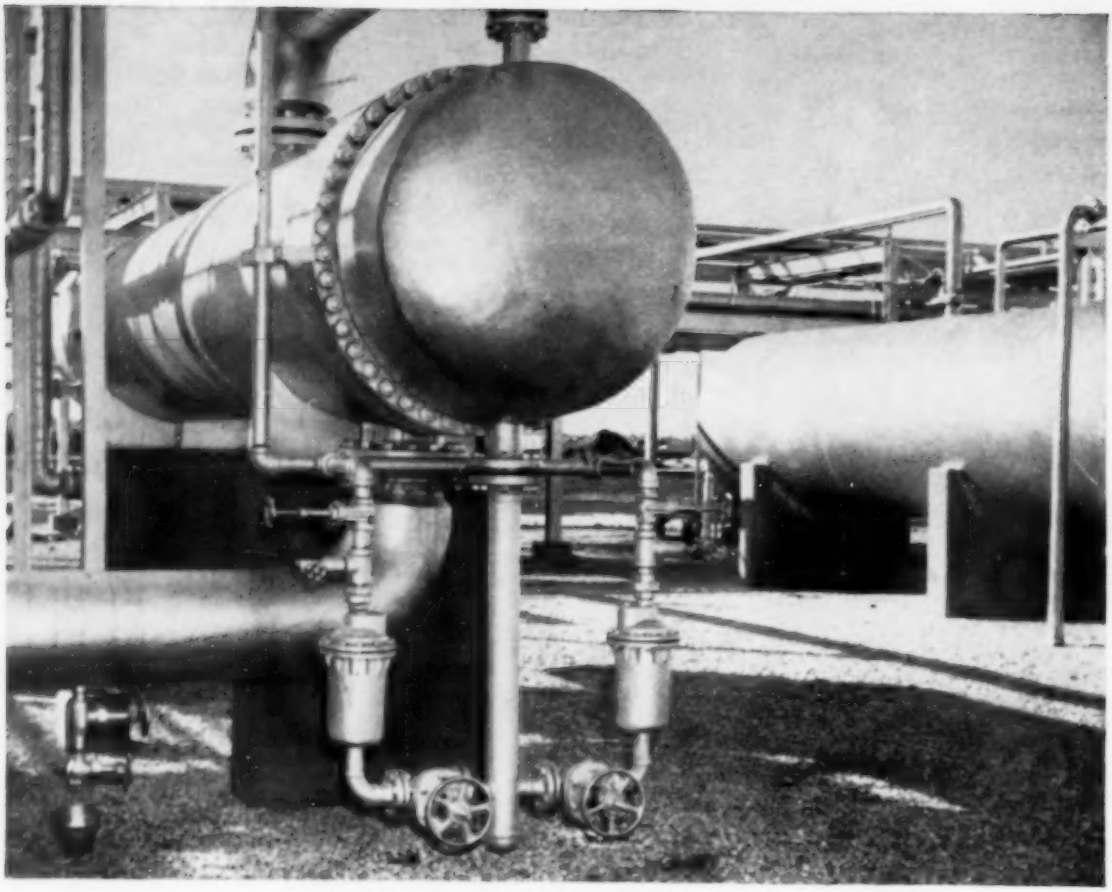
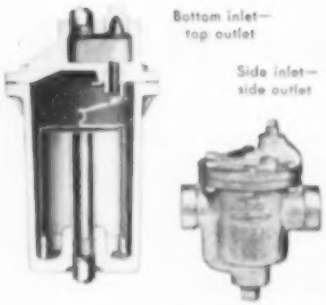


A Look at Low Cost Maintenance . . .



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JUST a couple of steam traps stuck out in a cycling plant, along with a lot of valves and piping . . . that's what the picture shows. What the picture doesn't show is the big reason for the choice of those two Armstrong traps: *low cost maintenance.*

There is a tremendous investment in capital equipment riding on the performance of such small auxiliaries as steam traps. They have to work right 24 hours a day. Troublesome traps can eat up maintenance time like the desert can soak up water. That's why a photographer could work 'til doomsday without getting pictures of all the Armstrong traps in petroleum plants around the world. They've proved themselves on the maintenance score!

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583

keting dept., and in 1954 was transferred to the petrochemical activities unit.

Mr. Hurd received a degree in chemical engineering in 1942 and joined Gulf Research & Development Co. the same year. He shifted to Gulf's general office chemical staff in 1951. Since that time he has been engaged in process engineering studies of chemical projects.

Mr. Paules

Mr. Byrne

Charles E. Paules has been named a vice-president, director, and member of the executive committee of Esso Research and Engineering Co. He succeeds the late **Eric Luster.**

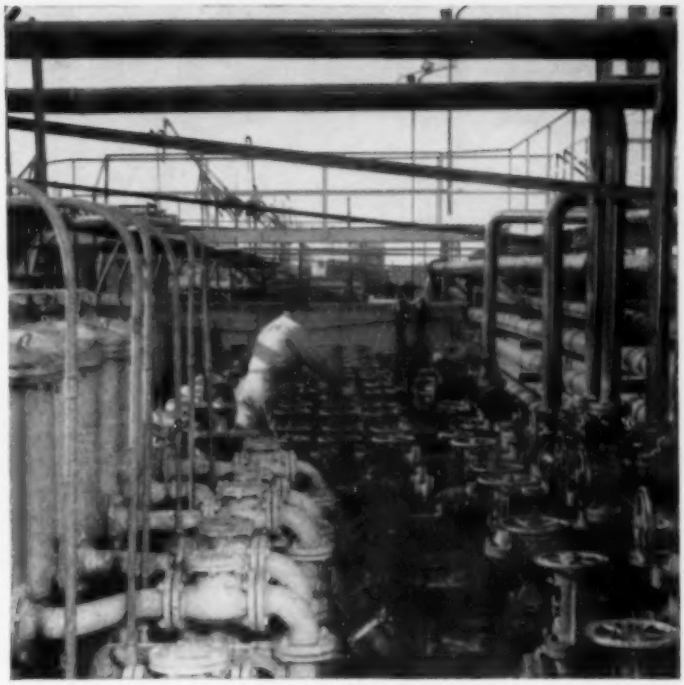
Paules has been with the company since 1919, three years after his graduation from Lehigh University with a degree in civil engineering. He was the firm's chief engineer from 1949 to 1954 and had previously held the positions of assistant and associate chief engineer.

He was closely associated with the construction in Baton Rouge of the world's first Fluid catalytic cracking unit. Since the end of World War II he has held key supervisory roles in the building of major oil installations in this country, England, Europe, South Africa and India.

Deputy to vice-president Paules is **P. J. Byrne,** formerly manager of the Esso engineering organization situated at the Bayway refinery. Byrne received his B.S. and M.S. degrees in chemical engineering from M.I.T. and served as a professor in that field at the University of Notre Dame from 1921-23. He began with the company in 1927 and has served as assistant and as associate chief engineer.

Byrne's replacement as engineering manager is **John W. Packie,** who has been chief design engineer since 1951. Packie is a graduate in mechanical engineering of Stevens Institute of Technology. He joined the company in 1929.

S. H. Bennison has joined the Wesco Refining Co., Rangely, Colo.,



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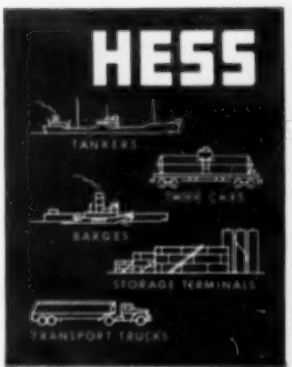

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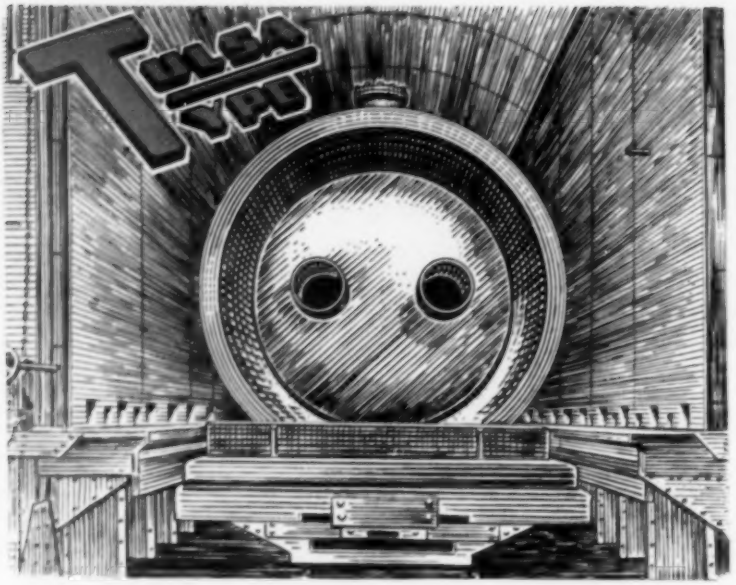
(To obtain more data on advertised products see page 916)



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as president of the firm. Other officers of the company are **Henry Ricci,** general manager, **Lawrence Merkley,** refinery superintendent, and **Russell Fidler,** comptroller.

A. M. Hovlid is now director of industrial relations for Continental Oil Co.'s petrochemical dept. He was previously an administrative assistant to Continental Oil's manager of industrial relations.

The petrochemical dept. also has promoted **W. W. Clark** from administrative assistant to chemical market research assistant. Both men have their headquarters in Houston.

Gayden Derickson has been promoted to asst. manager of the manufacturing engineering dept., Shell Oil Co., with headquarters in New York. He was the asst. chief engineer-design at Shell's Wood River, Ill., refinery. He has been succeeded there by **E. D. Underwood,** formerly assistant chief engineer at the Martinez, Calif., refinery.

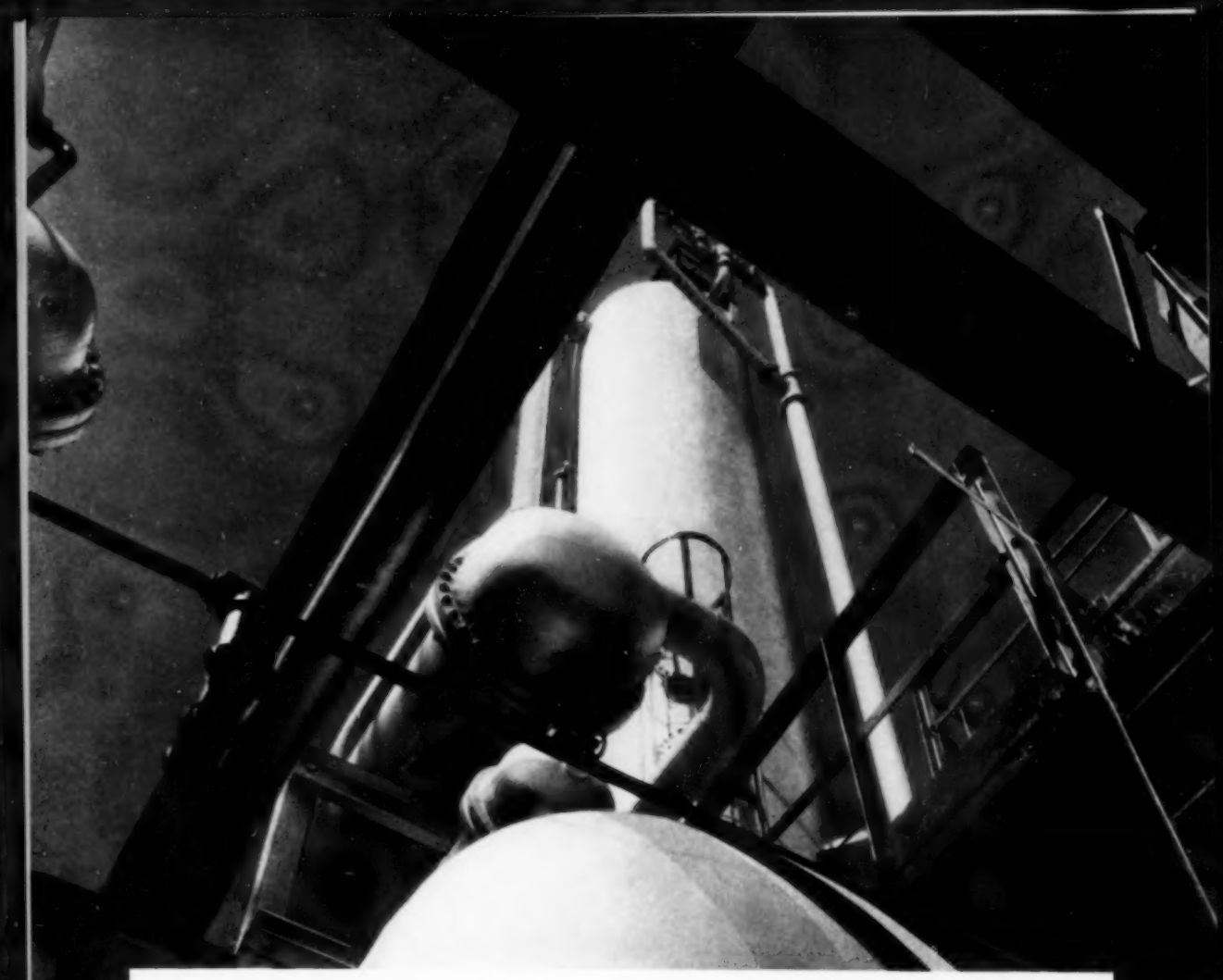
Derickson is a 1934 graduate of Tulane University, where he received a B.E. in civil engineering. He joined Shell in 1935.

Richard H. Tubman has succeeded **L. J. Snyder** as asst. superintendent of the Wilmington-Dominguez refineries. Snyder has been transferred to the Houston refinery for a post of greater responsibility. Tubman holds a B.E. degree in gas engineering from Johns Hopkins University. He began with Shell in 1937 at the Norco refinery as a junior analytical chemist.

He has been replaced as manager of the catalytic cracking dept. by **Donald L. Cleveland,** who was previously manager of effluent control and utilities. Cleveland took a B.S. in chemical engineering from the California Institute of Technology and joined Shell in 1934 as a junior chemist in the control laboratory at the Martinez refinery.

George F. Mayse, previously manager of fire and safety dept. at Wilmington-Dominguez, has been transferred to Anacortes, where he has become manager of effluent control and utilities. Mayse joined Shell in 1933 after his graduation from the University of Southern California with a B.S. degree in mechanical engineering.

Manager of the fire and safety dept. at Wilmington-Dominguez is now **Robert M. Leyhe.** Leyhe began with Shell in 1928 as a junior inspector in the control laboratory. He received his schooling at the University of California at Los Angeles.



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Thinking of a *new* motor oil for "fall and winter changeover"?

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Oils that will prevent engine sludge... particularly under cold-weather, low-power, short-trip driving conditions... have important sales appeal to the mass passenger car field, as well as in commercial urban fleet markets.

If you are marketing a multi-grade oil having these cold-weather advantages, Du Pont Lube Oil Additives 564 or 565 will provide *a substantial part* of the viscosity index improvement which is needed. For this reason, these *ashless polymeric* additives are very economical in the production of such oils.

Du Pont Lube Oil Additive 564, because of its relatively low molecular weight, provides motor oils with *good shear stability* and viscosity index improvement, coupled with outstanding detergency.

Du Pont Lube Oil Additive 565, having a higher molecular weight, provides the same outstanding detergency under low-duty driving conditions plus *high viscosity index improvement.* These characteristics enable you to manufacture multi-grade oils of superior quality at considerably reduced treating costs.

Commercial quantities of both additives are now available. You can readily test their effectiveness in your own base oils by obtaining samples from any of our regional offices listed below.

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By Peter J. Gaylor, Patent Attorney, Elizabeth, N. J.

Additive for Stabilizing Treated Distillates

PETROLEUM distillates which have been treated with a hypochlorite solution or other chlorine-containing compounds frequently fail to pass the copper strip test, apparently because of unstable chlorine compounds. It has been found that the presence of 10 ppm. or more of chlorine will cause staining of the copper strip.

In its patent No. 2,702,237, Standard Oil Company (Ind.) claims to be able to inhibit such copper staining by addition to the distillate of 0.0001% to 0.5% of morpholine. In one example, the addition of 0.007% of morpholine in petroleum distillate of 315° F.-390° F. boiling range and containing 35 ppm. of chlorine resulted in a product having a passing copper strip corrosion number of 2. In the case of another oil containing 74 ppm. of chlorine, addition of 0.009% morpholine gave a product having a passing copper strip corrosion number of 3.

Gas Washing Will Clear Lube Oil Additives

CONCENTRATES of high molecular weight polymers and copolymers useful as viscosity index improvers, pour point depressors, etc., often become cloudy or semi-turbid in appearance. They are clarified, according to the Esso Research and Engineering Co.'s patent No. 2,703,783 in the following manner:

The oil concentrate of the addition agent containing from 5% to 80% of the additive material is heated to a temperature within a range of from about 210° F. to 350° F. While at this temperature a gaseous aquophylic substance is passed through the oil concentrate for a period of time ranging from about five minutes to one hour. Although the exact mechanism of this processing step is not known, it is believed that the action of the aquophylic gaseous substance is such that coagulation or agglomeration of the small particles of contaminants occurs, the agglomerated particles being of sufficient size as to be removable by filtration.

As the gaseous aquophylic substance, it is preferred to use steam. However, other substances such as hydrogen chloride gas, ammonia gas, carbon dioxide, or mixtures of the above in any proportion may be used with good effect.

The oil concentrate should be subjected to the action of the aquophylic gas long enough to effect the desired clarification. At this stage, though, it is still cloudy, due both to the agglomerated, insoluble contaminants and to the presence of condensed moisture from the steam. It may then be dried by (1) blowing an inert gas through the heated oil blend, or (2) adding a suitable drying agent-filter aid, such as those diatomaceous earths sold under trades names of HyFlo, Celite, Filter-cel, etc., familiar in the art.

The resulting oil blend may then be filtered, with the help of the filter aid present, through a suitable filtering medium. In some instances it may be necessary to subject the filtered oil blend to a second treatment with the aquophylic gas although, in general, this can be avoided by sufficient treatment the first time.

Patents Issued in April

The following classified listing gives the patent number, patentee, or assignee, and a brief description of all patents believed to be of interest to the petroleum processing industries, as contained in the Official Gazette of the U. S. Patent Office for April 5, 12, 19, and 26, 1955, Vol. 693, Nos. 1-4.

PROCESSES

Refining

2,705,594 (Aubery Keith Brewer) Emulsifilm diffusion.
2,705,698 (Esso Research & Engineering Co.) Process for recovering separated olefins and diolefins.
2,705,699 (Phillips Petroleum Co.) Packed column and control system therefor.
2,705,734 (Rubrchemie Aktiengesellschaft) Method for obtaining pure olefins from olefin-containing hydrocarbon mixtures, using aqueous zinc chloride.
2,706,532 (Adsorption Research Corp.) Fluid treating apparatus.
2,706,703 (British Petroleum Co.) Catalytic desulfurisation of petroleum hydrocarbons in presence of hydrogen.

Conversions

2,705,080 (Socony-Vacuum Oil Co.) Apparatus for gravitating granular solids between zones of different pressure.
2,705,216 (Socony-Vacuum Oil Co.) Method and apparatus for converting hydrocarbons.
2,705,664 (Sun Oil Co.) Elevation of granular solids.
2,705,697 (Percy H. Royster) Process for the destructive distillation of carbonaceous materials.
2,706,187 (Sun Oil Co.) Process for catalytically hydrogenating hydrocarbon oils (gas oil and lube oil).
2,706,208 (Universal Oil Products Co.) Dehydrogenation of hydrocarbons containing an alkylcyclopentane ring, in presence of platinum.
2,706,210 (Wulff Process Co.) Process suitable for converting primary hydrocarbons to secondary hydrocarbons (acetylene).
2,706,211 (Phillips Petroleum Co.) Hydrocarbon polymerization and hydrogenation process catalyzed by nickel oxide.
2,706,704 (Esso Research & Engineering Co.) Fluidized solids reactor and process in the conversion of hydrocarbons.
2,706,705 (Badische Anilin- & Soda-Fabrik Aktiengesellschaft) Two-stage destructive hydrogenation process for the production of gasoline from hydrocarbon oils.
2,706,741 (California Research Corp.) Catalytic dehydrogenation of hydrocarbons, using alumina, silica, beryllia and Group VI metal.
2,707,147 (Hercules Powder Co.) Production of domestic gas by oxidizing hydrocarbons in tube containing dehydrogenating catalyst.
2,707,148 (Houdry Process Corp.) Process for pyrolytic cracking of hydrocarbons and gasification of coal.
2,707,163 (Compagnie Francaise des Essences Synthetiques Societe Anonyme) Method for the treatment of solid or liquid carbonaceous materials, using a sequence of columns, using hydrogenating gas.

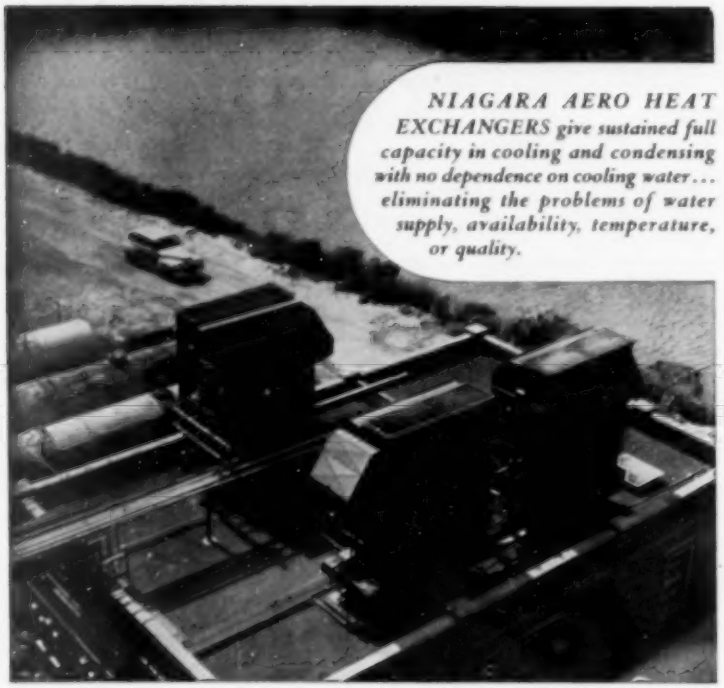
PRODUCTS

Chemicals

2,705,241 (The Texas Co.) Process for producing high viscosity wax oxidate by catalytic oxidation of petrolatum.
2,705,248 (Imperial Chemical Industries Ltd.) Production of xylenes by isomerization, etc.
2,705,703 (Esso Research & Engineering Co.) Process for raising the softening point of cracked distillate resins with diolefin polymer.
2,705,706 (M. W. Kellogg Co.) Polymerization of perhalocarbons with trifluorodichloropropionyl peroxide.
2,705,729 (Esso Research & Engineering Co.) Carbonylation (oxonation) of olefins.
2,706,147 (Texaco Development Corp.) Process for ammonia manufacture in presence of manganese oxide.
2,706,184 (Phillips Petroleum Co.) Rubber vulcanizing compositions.
2,706,192 (Phillips Petroleum Co.) Method for increasing polymerization rate in salt-antifreeze emulsion polymerization systems.
2,706,194 (Shell Development Co.) Esters of phosphonic acids.
2,706,206 (Esso Research & Engineering Co.) Dispersion of solid cobalt catalyst in organic liquid for carbonylation.
2,706,253 (Phillips Petroleum Co.) Selective wave length filter spectrophotometer.
2,706,707 (Esso Research & Engineering Co.) Extractive distillation of oxygenated organic compounds in presence of cyclic compound.
2,706,708 (M. W. Kellogg Co.) Process for separating cumene from cumene hydroperoxide.
2,706,709 (Badische Anilin- & Soda-Fabrik Aktiengesellschaft) Photochemical chlorination of saturated gaseous hydrocarbon.
2,706,710 (Phillips Petroleum Co.) Synthesis of 2-methyl-5-ethylpyridine from alkyl vinyl ethers and ammonia.
2,706,714 (British Petroleum Co. Ltd.) Production of sulfur-containing organic compounds by reacting hydrocarbon hydroperoxide with sulfur chloride.
2,706,716 (British Petroleum Co. Ltd.) Separation of sulfonated organic compounds from sulfur dioxide.
2,706,740 (California Research Corp.) Process for producing unsaturated hydrocarbons and oxygen compounds of hydrocarbons by oxidizing hydrocarbon gases, using stable blue luminescent zone.
2,707,176 (Monsanto Chemical Co.) Tricresyl phosphate-chlorinated biphenyl functional fluid improved by alkylated polystyrene.
2,707,195 (Witco Chemical Co.) Method of desulfurizing naphthenic acid.
2,707,197 (Institut Francais du Petrole des Carburants et Lubrifiants) Process for the separation or purification of organic mixtures or products separating cyclohexane and benzene by chlorination.

Fuels

2,705,193 (Charles B. Francis) Conversion in presence of hematite of liquid hydrocarbons to fixed fuel gases.
2,705,672 (Pittsburgh Consolidation Coal Co.) Manufacture of water gas by feeding steam and carbonaceous solids into calcium oxide zone.
2,706,149 (Esso Research & Engineering Co.) Fuel oil treated with zinc to reduce deposit tendency.
2,706,150 (Power Jets Ltd.) Gas producer for use with a turbine power plant.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Niagara Aero Heat Exchangers at a Plant of the Heyden Chemical Corp.

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Over 35 Years Service in Industrial Air Engineering

Dept. PP, **405 Lexington Ave.** **New York 17, N. Y.**

2,706,677 (Esso Research & Engineering Co.) Amines & amides (dimethyl formamide) as anti-stalling additives.
2,706,706 (Institute of Gas Technology) Method of devolatizing coal fuel.

Lubricants

Re 23,979 (Shell Development Co.) Lubricant composition containing di-alkyl trihaloalkane phosphonate as an extreme pressure agent.
2,705,700 (Du Pont Co.) Composition containing surface-esterified siliceous solid and silicone oil.
2,705,724 (Esso Research & Engineering Co.) Reduction of acidity in synthetic ester lubes with olefin oxides.
2,706,176 (Standard Oil Co.-Ohio) Cutting oil derived from oxidized petroleum oil.
2,706,177 (Esso Research & Engineering Co.) Stabilization of organic sulfur-containing compounds with unsaturated ether.
2,706,715 (M. W. Kellogg Co.) Grease composition containing trifluorochloroethylene polymer.
2,706,905 (Esso Research & Engineering Co.) Apparatus for testing oil in lubricating systems.
2,707,159 (Lubri-Case Inc.) Wear-resistant ferrous metal articles and their production by treating surfaces with molten alkaline salt.
2,707,172 (Gulf Oil Corp.) Stabilized mineral oil lubricant compositions, using alkyl phenol and non-resinous condensation product.
2,707,173-5 (Gulf Oil Corp.) Stabilized mineral oil lubricant compositions.

Specialties

2,705,189 (Columbian Carbon Co.) Carbon black by decomposition of hydrocarbons.
2,705,190 (Columbian Carbon Co.) Apparatus for carbon black manufacture.
2,705,240 (Universal Oil Products Co.) Stabilization of organic compounds with resinous oxidation product of 2,5-dialkylphenol.
2,705,681 (Standard Oil Co.-Ind.) Bituminous composition and process of making it, employing sludge sulfonate.
2,705,694 (Esso Research & Engineering Co.) Insecticidal compositions comprising diethyl thiophosphoric acid disulfide.
2,705,731 (Ethyl Corp.) Separation of gamma benzene hexachloride.
2,706,151 (Atlantic Refining Co.) Process and composition for promoting uniform seed germination, using benzene sulfonate, chlorophyll salt, etc.
2,706,172 (Ethyl Corp.) Manufacture of benzene hexachloride.
2,706,688 (Shell Development Co.) Asphalt emulsion containing silica hydrogel and lower fatty acid salt of an alkyl amine.
2,706,713 (Esso Research & Engineering Co.) Textile oil containing oil soluble petroleum sulfonate, and ethylene oxide-oleic acid condensate.
2,706,714 (Cities Service Research & Development Co.) Method of inhibiting corrosion of metals with acetone-quinoline reaction product.
2,706,717 (Badische Anilin- & Soda-Fabrik Aktiengesellschaft) Vinyl ether-containing hydraulic fluids.
2,706,719 (Esso Research & Engineering Co.) Polyethylene-wax compositions and process for making same.

Miscellaneous

Re 23,983 (Standard Oil Co.-Ohio) Liquid level indicator.
2,705,053 (Doak Aircraft Co., Inc.) Oil degasification.
2,705,406 (Union Stock Yards & Transit Co.) Apparatus and method for shipping and storing volatile hydrocarbons.
2,705,420 (Esso Research & Engineering Co.) Method for continuous true vapor pressure determinations.
2,705,827 (Standard Oil Co.-Ind.) Portable apparatus for stress-relieving of vessels.
2,706,027 (Esso Research & Engineering Co.) Air control system in power transmitting assembly, including air operated clutch with timer.
2,706,168 (Gulf Research & Development Co.) Treatment of magnesia-calcium oxide silica composites and cracking process.
2,706,254 (California Research Corp.) Operation of pipelines by use of radioactive material to indicate change in material transported.
2,706,527 (Federativna Narodna Republika Jugoslavija Savet Za Industriju) Protective device for gasoline tanks.
2,707,192 (The Texas Co.) Method for treating product of conversion of hydrogen and carbon monoxide into synthetic fuel.

EQUIPMENT

Processing, general

2,705,406 (Union Stock Yards & Transit Co.) Apparatus for shipping and storing hydrocarbons.

(To obtain more data on advertised products see page 916)

PLANT PROFITS UP $77,000 AFTER CHEMICAL CLEANING

DOWELL method of cleaning lines and process equipment cut plant turn-around time 22 days

Dowell was called to remove scale from pipe lines and process equipment in a plant where the semi-annual turn-around usually meant long, costly down-time. Dowell engineers used liquid solvents to do the job. It was not necessary to dismantle the equipment as the chemicals were introduced through regular connections. The job was done in far less time than ever before.

In fact, outage time for the year was reduced 22 days, representing an estimated $77,000 additional profit to the plant. As a result, Dowell Service was made a regular part of the plant's turn-around maintenance program.

The Dowell method of preventive maintenance cleaning with chemicals has helped to avoid the replacement of many miles of water and process lines and thousands of dollars worth of plant equipment. Chemical cleaning often uncovers weak points and helps to avoid later failures.

For complete details, call the nearest Dowell office. Or write DOWELL INCORPORATED, Tulsa 1, Okla., Dept. F-32.

chemical cleaning service for industry

DOWELL

A SERVICE SUBSIDIARY OF THE DOW CHEMICAL COMPANY

(To obtain more data on advertised products see page 916)

Why

this Jam-Proof 65R

RIDGID

is most pipe threader for your money

Easiest to Use... Threads 1", 1¼", 1½" and 2" pipe and conduit with 1 set of chasers that adjust to size in 10 seconds. Mistake-proof self-centering workholder sets instantly to size. Threader can't jam—it kicks out automatically when standard length thread is cut. Unbeatable speed, least work.

Perfect Threads... 65R cuts beautiful threads—and you find the factory test sample in your new die stock to prove it. No other threader gives you as much for your money.

Ask to see the 65R at your Supply House. Try it, buy it—it's a bargain in satisfaction.

The Ridge Tool Company • Elyria, Ohio, U. S. A.

RIDGID

Work-Saver Pipe Tools

Patents

2,705,407 (John O. Colonna) Sea water fractionation.
2,705,476 (Babcock & Wilcox Co.) Fluid heater wall.
2,705,543 (Lorenzo Torres) Differential flow liquid-gas separation.
2,705,545 (Karl E. A. Gothberg) Self-emptying liquid separator.
2,705,594 (Aubrey Keith Brewer) Emulsifilm diffusion.
2,705,615 (Shell Development Co.) Rotary regenerative heat exchanger with shutters.
2,705,620 (Aktiebolaget Separator) Apparatus for mixing fluids insoluble in one another.
2,705,664 (Sun Oil Co.) Elevation of granular solids.
2,705,699 (Phillips Petroleum Co.) Packed column and control system therefor.
2,705,996 (Surface Combustion Corp.) Gas mixer.
2,706,015 (Superior Tank and Construction Co.) Wash tank and gas separator.
2,706,045 (Harold B. Large) Separating cone for material and liquid.
2,706,106 (Charles Roswell) Heat exchange apparatus.
2,706,531 (Sivalls Tanks, Inc.) Gas and multiple liquid separator apparatus.
2,706,532 (Adsorption Research Corp.) Fluid treating apparatus.
2,706,533 (Research Corp.) Gas conditioning method and apparatus.
2,706,619 (Graves-Stambaugh Corp.) Heat exchanger.
2,706,620 (Graves-Stambaugh Corp.) Heat exchanger.
2,706,622 (Gustaf A. Staaf) Mixing or stirring apparatus.
2,707,022 (Whiting Corp.) Heater for multiple effect evaporators.
2,707,095 (R-W Mfg. Co.) Underground heat exchanger.
2,707,096 (Hartford National Bank & Trust Co.) Heat exchanger.

Instruments

Re 23,983 (Standard Oil Co.-Ohio) Liquid level indicator.
2,706,406 (Stanolind Oil & Gas Co.) Fluid flowmeter.
2,706,408 (Francis Holbrook) Pitot tube.
2,706,409 (Joseph Henry Preston) Pitot tube flow meter.
2,706,411 (James A. Bircher) Thermoelectric device for measuring high temperatures.
2,706,754 (Steve V. Palladino, Jr.) Fluid level signal.
2,706,755 (Louis R. Krasno) Automatic fluid level indicator.
2,706,908 (United Gas Corp.) Apparatus for determining volumes of solids.
2,707,198 (Elwyn D. Jones) Thermocouple.
2,707,236 (Magnaflux Corp.) Method of detecting flaws.

Pumps & Compressors

2,705,458 (Stuart O. Sunden) Pump.
2,705,459 (William M. Wilson's Sons) Rotary pump.
2,705,591 (Cleaver-Brooks Co.) Vane-type compressor.
2,705,873 (L'Air Liquide, Societe de George Claude) Pumping plant for liquefied gas.
2,705,922 (Dresser Industries) Fluid pump or motor of the rotary screw type.
2,706,016 (Peter Schlumbohm) Friction pump.
2,706,452 (Plessy Co. Ltd.) Gear pump.
2,707,074 (Chester E. Tussey) Pump.

Valves & Fittings

Re 23,985 (Edward Valves) Valve construction.
2,705,608 (Refinite Corp.) Non-chattering pilot controlled diaphragm valve.
2,705,609 (Atwood & Morrill Co.) Plug valve.
2,705,610 (Crane Co.) Conduit valve.
2,706,487 (John Hart Wilson) Release valves.
2,706,488 (Hersey Mfg. Co.) Anti-back-flow device.
2,706,489 (Fairbanks, Morse & Co.) Pressure relief valve.
2,706,492 (Richard D. Horland) Control valve.
2,706,997 (Elliott E. Moody) Plug-type valve.
2,707,051 (Harold J. Mailhot and Albert G. H. Vanderpoel) Pressure regulator-filter device.
2,707,078 (Robertshaw-Fulton Controls Co.) Combined thermostat and automatic pilot control.

Miscellaneous

2,705,627 (Standard Oil Co.-Ind.) Portable apparatus for stress-relieving of vessels.
2,705,811 (Standard Oil Co.-Ohio) Plug puller coupling.
2,706,398 (Consolidated Engineering Corp.) Leak detector.
2,706,527 (Geza Guljas, Ladislav Slavic, and Milivoj Stefanovic) Protective device for gasoline tanks.
2,706,999 (Henry M. H. Pickard) Doors or covers for pressure vessels.

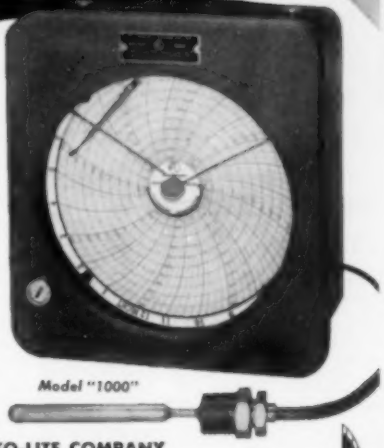
(To obtain more data on advertised products see page 916)

AUTO-LITE

TEMPERATURE RECORDING...

Newly designed, Model "1000" Auto-Lite Recorder gives permanent proof of temperature behavior. • 6" clear reading chart; various standard ranges from minus 40°F. to plus 550°F. • 3 standard types; choice of 24-hr. or 7-day cycle. • Electric or mechanical chart drive. • With capillary tubing for remote reading. Priced from $49.50.

Send for new catalog describing many styles of Auto-Lite temperature Recorders and Indicators.



Model "1000"

THE ELECTRIC AUTO-LITE COMPANY
INSTRUMENT AND GAUGE DIVISION
TOLEDO 1, OHIO
NEW YORK • CHICAGO • SARNIA, ONTARIO

TEMPERATURE RECORDERS

IDEAL

You can depend on WIEDEKE quality

PACKAGE BOILER

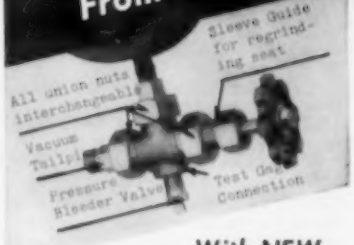
. . . and Stationary Fire Tube Boiler Tubes can be rolled and flared in one operation with this Modern Parallel Rolling Tube Expander.

See your Dealer or Write us for Bulletin 3400.

Guard holds Flare Roll back—desirable for rolling Tubes closely spaced in thin Tube Sheets.

THE GUSTAV WIEDEKE COMPANY
DAYTON 1, OHIO

REDUCE THREADED CONNECTIONS From 10 to 3



With NEW

JERGUSON VALVES

For Instrument Piping and General Use

YOU can make tremendous time and cost savings with this complete new line of Jerguson Valves for Instrument Piping and General Use.

Threaded connections are reduced from 10 to 3, for these valves combine unions, nipples, reducers, elbows, tees, valve, and drain valve in one space saving unit. One valve replaces the multiple set-up of valves and connections formerly used.

Nine different styles . . . with or without union outlet, as well as offset and jacketed valves.

Features available include safety shut-off; double-seating stem for repacking under pressure; regular or quick-closing stem and lever; regrindable and renewable seats; pressure bleeder valve and test gage connection; outside screw and yoke when desired; throttling stem when desired.

Write for full details today. Ask for Data Unit on General Use Valves.

JERGUSON

Gages and Valves for the Observation of Liquids and Leads

JERGUSON GAGE & VALVE COMPANY
100 Felleway, Somerville 45, Mass.
Offices in Major Cities
Jerguson Trees Gage & Valve Co., Ltd., London, Eng.
Pétrole Service, Paris, France

Dependable

Struthers Wells

MIXING EQUIPMENT

A complete line of Mixers designed for handling everything from the

THINNEST LIQUIDS to the THICKEST DOUGHS

Struthers Wells builds a complete line of Mixing Equipment for every purpose, including liquid agitators, hydrogenators, kneading machines and intensive mixers. Our extensive machine shops, plate fabricating facilities, forging equipment—combined with years of experience in the design of Mixing Equipment make Struthers Wells one of the foremost suppliers of this type of equipment.

LIQUID AGITATOR

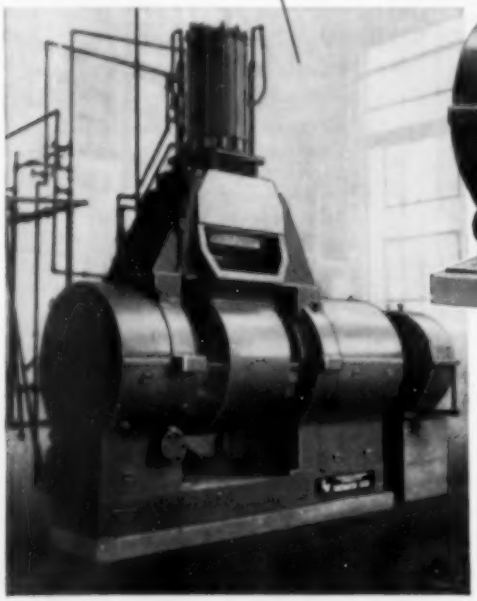
Equipped with patented Radial Propellers is suitable for hydrogenation and mixing a wide range of liquids. Any materials that will flow while being mixed can be handled under vacuum, low or high pressure with heating and cooling when required.

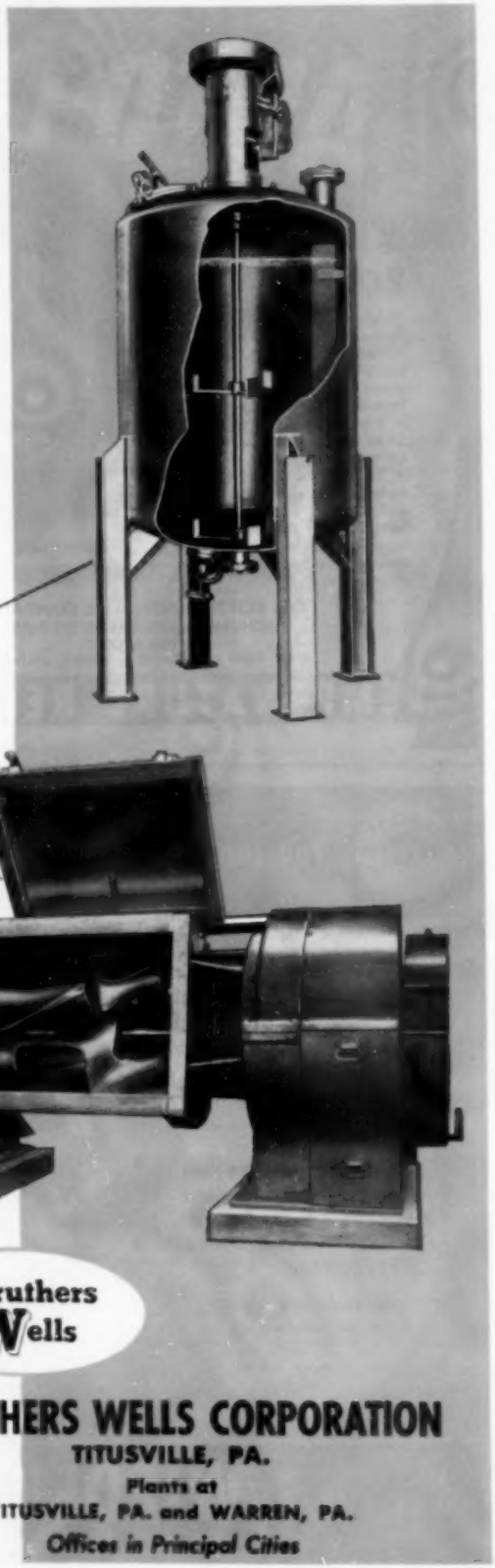
KNEADING MACHINE

Made in several types, Struthers Wells Kneading Machines are used for mixing stiff pastes. Some models may be rotated to a full inverted position for discharging.

INTENSIVE MIXER

Extremely powerful, Struthers Wells Intensive Mixers are suitable for processing plastics, rubber, asphalt tile and similar materials.





Write for literature on equipment for your mixing requirements

Struthers Wells

STRUTHERS WELLS CORPORATION

TITUSVILLE, PA.

Plants at

TITUSVILLE, PA. and WARREN, PA.

Offices in Principal Cities

(To obtain more data on advertised products see page 916)

Taylor Cos. Cross Frisco Bay

San Francisco offices and plant of Taylor Instrument Companies have been moved across the bay to 1661 Timothy Dr., San Leandro, to modern and enlarged facilities. The new plant is capable of duplicating many manufacturing and repair techniques followed in the company's main plant in Rochester, N. Y.

Set up to make repairs and assemble new instruments, the plant contains 16,800 sq. ft. of floor space and has extensive parking facilities.

Ethyl Expands Baton Rouge Labs

Ethyl Corp.'s expansion program for its research facilities has entered a major phase with the begining of construction of a new laboratory building at Baton Rouge, La. The move will substantially expand the company's laboratory space for chemical products research, specifically in the fields of petrochemicals, chlorination, organometallics, electrochemistry and others.

The broad plan of Ethyl's expansion calls for all research and engineering of chemical products and manufacturing processes to be consolidated at the Baton Rouge location. Research in the automotive products field will be centralized at the expanding Detroit laboratories.

The new building is expected to cost $450,000 and will provide facilities on the modular design for 60 laboratory and office personnel. Completion of the 18,000-sq.-ft building is expected in December, 1955.

CEC to Erect New Facilities

Consolidated Engineering Corp. will start construction this summer on a $1,500,000 building in the Hastings Ranch area of Pasadena, Calif. The site for the 120,000-sq.-ft., two-story structure is an 8-acre lot adjoining the company's main plant. In it will be put CEC's research, engineering, and marketing divisions.

The building is being designed with soundproofing, recessed fluorescent lighting, and the latest in laboratory facilities.

Germans to Make Catalysts

A German chemical firm, Kali Chemie, A. G., of Hanover, has been licensed by the Atlantic Refining Co. to make catalyst for Atlantic's high octane gasoline process known as "Catforming." The German firm will install new production facilities in its catalyst plant at Nienberg.

FIELD LUBRICATION SERVICE for users of Rockwell-Nordstrom plug valves is now being offered by the company on a national scale. Trucks carry lubricants, fittings, lubricant pumping equipment, and spare parts. They also have tool benches, a compressor for pneumatic tools, and even a hose reel for inaccessible locations. Company will service valves of other makes by arrangement.

Personnel Changes

Rockwell Manufacturing Co.—Nelson E. Davenport, sales engineer in the Meter and Valve Div., to asst. gas products manager with headquarters in Pittsburgh.

Vulcan Steel Container Co.—Ray Mitchell to sales manager, with headquarters at Birmingham, Ala.

Black, Sivalls & Bryson—John H. Raidl to sales manager of the West Coast district, with headquarters in Los Angeles.

Davison Chemical Co.—F. Clayton Nicholson to vice-president in charge of chemical operations, succeeding William B. McCloskey, who has been named vice-president of the parent firm, W. R. Grace & Co.

Erhart & Arthur, Inc.—David G. Reynolds to chief process engineer, with headquarters at the company's offices in Los Angeles.

Lummus Co.—James H. Curtis to vice-president.

ALCO Products, Inc. — James J. Reynolds to vice-president of operations. He was formerly vice-president of industrial relations.

Nordberg Mfg. Co.—Louis C. Rove to district manager, Great Lakes territory, succeeding William C. Young, who was transferred to industrial and petroleum sales.

Ampco Metal, Inc.—J. P. Henry, formerly asst. general sales manager, to general sales manager; R. J. Severson, formerly manager of technical sales, to asst. general sales manager; James A. Arter to vice-president of manufacturing.

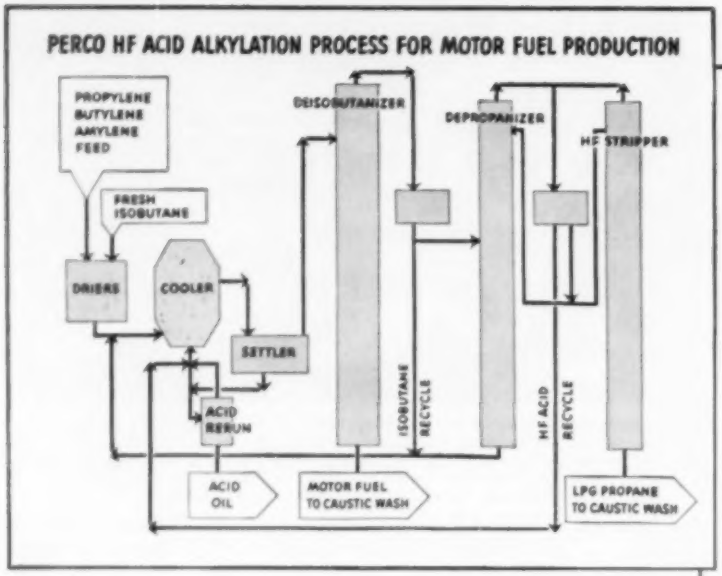
Kuljian Corp.—Hilton A. Levonian to vice-president in charge of consulting engineering.

Consolidated Engineering Corp.—A. H. Hartman, sales and advertising director for Consolidated Vacuum Corp., a CEC subsidiary, to marketing director of the Vacuum Corp.'s section of the recently integrated marketing organization; James C. Kyle to technical director of the CEC transducer division.

Baird Associates, Inc. — Potter Trainer, Houston area sales representative, to the main office at Cambridge, Mass., where he will work as an applications engineer on commercial uses for certain recently declassi-

Get the advantages of

PERCO HF ALKYLATION



Liquid feed, containing olefins and isobutane, is passed through driers and fed into a cooler along with liquid recycle hydrofluoric acid. Hydrocarbons and recycle acid then flow to the settler. The acid phase is recycled to the cooler. The hydrocarbon phase is fractionated to separate high octane motor fuel alkylate from recycle isobutane.

Meet the increasing demand for higher octane motor fuels with Perco HF Alkylation. A Perco plant is exceptionally economical to install and operate. Find out how Perco HF Alkylation increases octanes and profits. For complete information consult Perco today.

Here are 10 benefits you get with PERCO

1 High octane and high blending value.

2 High yield of motor fuel per barrel of olefin.

3 Odorless, clean-burning fuel.

4 Creates no gum problem in any blend.

5 Simplicity for low investment and low operating costs.

6 Removes high volatility isobutane from motor fuel.

7 Low acid consumption.

8 Safety record equal to other refining units.

9 High on-stream factor.

10 High efficiency through infrared analyzer control.

PERCO *Division*

Phillips 66

PERCO* *A SERVICE MARK

PHILLIPS PETROLEUM COMPANY

BARTLESVILLE, OKLAHOMA

(To obtain more data on advertised products see page 916)

fied developments in the field of instrumentation.

Trane Co.—R. James Trane, Wayne J. Hood, and Thomas J. Hancock, to executive vice-presidents; Richard G. Pearse, Sr., to vice-president.

Dresser Industries—H. P. Boncher and W. D. Miller to operating vice-presidents.

Visco Products Co.—D. M. Jacks, sales manager, and Dr. W. H. Kirkpatrick, technical director, to vice-president. Both retain their current assignments.

National Aluminate Corp.—H. R. Powers to vice-president of industrial div. sales, Gage Averill to vice-president of catalyst div. sales, Alphonso Cantalini to vice-president, continuing in his present capacity of European manager; H. E. Berg, manager of sales development, W. H. Thompson, manager of product development, and A. O. Jaros, legal advisor, have been promoted to asst. vice-president.

NEW QUALITY CONTROL LAB at the Beaver Falls, Pa., plant of Babcock & Wilcox's Tubular Products Div. handles inspection and testing of steel products as well as research into new alloys. Fast chemical analysis of metals for the mill a mile away is provided by pneumatic tube, which brings samples to the lab, and telautograph, which wires back details. Quantometers in the lab can find composition of steels within five to 15 minutes, using spectrographic methods.

Minneapolis - Honeywell Regulator Co.—John M. Wilson to chief engineer of the development and design div., engineering dept., of the Brown Instruments Div.

B-I-F Industries, Inc. — M. H. Strickland to manager of industrial sales, Chicago district.

Calumet & Hecla—C. P. Whitlock to sales representative in Philadelphia, located in the Liberty Trust Building.

Hoke toggle valves open and close with a single, positive motion like flipping a light switch. Use them on your precision test equipment for gas or liquid control at pressures up to 1000 psi. Seat and stem seals are tight enough for most vacuum work.

In instrument panel service you can tell instantly that the valve is open (or closed) and the colored nylon handles identify fluids at a glance.

Available in angle and globe patterns in brass or stainless, 1/8" through 1/2" pipe (or with tube fittings).

May we send you catalog and data sheets?

HOKE **HOKE INCORPORATED**
Fluid Control Specialists
161 S. DEAN STREET, ENGLEWOOD, N. J.

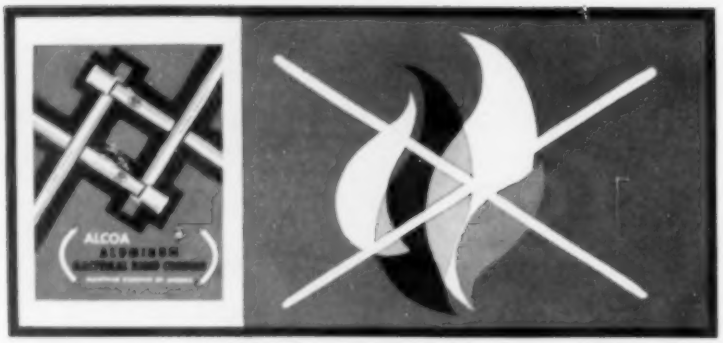
NO.1 in a series of **ALUMICOAT APPLICATIONS**

OIL REFINERY EQUIPMENT protected with *Alumicoat*

ALUMICOAT is a valuable industrial innovation that provides a metallurgical bond of pure aluminum and its alloys to steel! ALUMICOAT offers a firm resistance against chemical action and extreme temperatures especially important in oil refinery installations . . . resulting in a substantially improved process and longer life for the treated equipment.

Alumicoat can solve your corrosion and oxidation problems! Write for descriptive folder.

ARTHUR TICKLE ENGINEERING WORKS, Inc.
22 Delevan Street, Brooklyn 31, N. Y. MAin 5-4200



Protect Against Sparks and Rust With Nonsparking, Corrosion-Resistant Alcoa® Aluminum Rigid Conduit!

Rigid conduit of Alcoa Aluminum protects petroleum processing plants against two costly things—sparks and rust. And costs less than any other corrosion-resistant, nonsparking, metallic conduit!

You'll find all the facts on this lowest cost, nonsparking, corrosion-resistant, rigid conduit in this book published by Alcoa. Facts on applications, advantages, installation and sizes. Send for your free copy, today.

Just fill out the coupon and mail to: ALUMINUM COMPANY OF AMERICA, 2324-F Alcoa Building, Mellon Square, Pittsburgh 19, Pennsylvania.

Your Guide to Aluminum Value

Gentlemen:

Please send me your book on the lowest cost, corrosion-resistant, nonsparking, rigid conduit: *Alcoa Aluminum Electrical Rigid Conduit.*

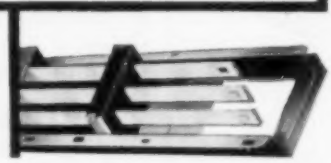
Name _____ Title _____

Company _____

Address _____

City _____ State _____

New Alcoa Aluminum Bus Conductor makes bus systems stronger, lighter; cuts costs! Bus systems using Alcoa's new No. 2 EC bus bar provide the best combination of strength, light weight and conductivity at a saving of up to 10%. Specify Alcoa Aluminum Bus Conductor.



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Single copies	50¢ each
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330 West 42nd Street, New York 36, N. Y.

Note: New York City residents add 3% sales tax

Broad and Arch Sts.; William R. Morrisey to sales representative in Chicago, with offices at 1 N. LaSalle St. Both are with the Wolverine Tube Div.

Ethyl Corp.—Alan C. Tully to president of Ethyl Corp. of Canada, Ltd., new subsidiary which will manufacture and market antiknock compound in Canada; Oscar B. Lewis to vice-president of the Canadian firm; S. T. Pruitt to domestic sales manager and Harold R. Berg to sales coordinator; Stuart Forbes to manager of Ethyl's central region, Leonard L. Huxtable to asst. manager of the southern region, and Laurence Reis to district manager of the Tulsa office.

Graver Water Conditioning Co.—J. D. Crell to sales engineer in New York City sales district.

ALCO Products—Richard B. Fairman to product manager of stationary and marine diesel engines.

Chiksan Co.—James L. Emerson to newly created post of assistant to the manager of the sales development dept.; Albert E. Plomp to senior salesman of Chiksan of Canada Ltd., with headquarters in Calgary.

Allied Chemical & Dye Corp.—James E. House to manager of the Detroit plant of Solvay Process Div.

General Controls Co.—William J. Darragh to manager of the New England district office; Ed Styron to field representative. Styron has been with Fluor Corp., Minneapolis-Honeywell, Atlantic Refining Co., Standard Oil of California, and others.

Cooper-Bessemer Corp. — Dwight R. Craig to administrative asst. in the engineering dept.

Tube Turns Div.—Edward F. Harrington to the sales development staff.

Houdry Process Corp. — Jack C. Dart, manager of research and development, to manager of the chemical div., a new unit formed to manufacture and sell petroleum and chemical processing catalysts; Dr. Alex G. Oblad, associate manager of research and development, succeeds Dart as manager of the Linwood, Pa., research laboratories; Ray Cross, manager of the catalyst plant at Paulsboro, N. J., to director of product manufacture for the new division; Howard D. Hartough to director of product sales and market development for the division.

(To obtain more data on advertised products see page 916)

GOING PLACES *deep-sea fishing with Cities Service...*

Cities Service, fishing for oil and gas in the waters of the Gulf of Mexico, last year brought in a record catch of liquid petroleum. Cities Service "anglers" are now fishing the deepest waters yet, in search of even more gas and oil, to meet the needs of its fast-growing customer family.

CITIES SERVICE

A Growth Company

HERE'S PROOF!—

Using dbpc
—no deposits

Using Antioxidant "A"
—heavy deposits

PETROLEUM PROCESSING, July, 1954, P. 1044-45

dbpc® Antioxidant

does not contribute to manifold deposits

Two popular antioxidants—**dbpc** inhibitor* and a well-known commercial gasoline gum inhibitor – were tested in a blend containing 60% catalytic cracked and 40% thermal cracked gasolines. The manifold test unit employed in the experiment consisted of the specially-designed manifold shown here, attached to a single-cylinder, air-cooled engine, with provisions for control of fuel rate and temperature. The air-fuel mixture from the carburetor entered the manifold which was heated by two 500-watt, pancake electric heaters attached to the manifold exterior. Manifold temperature averaged 255° F. Photographs above show identical sections of the two test manifolds.

Operational tests were made on both antioxidants and the results showed that **dbpc** did not contribute to manifold deposits. (Left photo). On the contrary, it actually tended to *reduce* deposits. Antioxidant "A," on the other hand, *increased* manifold deposits, as shown in the right hand photograph.

In addition to this outstanding feature, **dbpc,** *pound for pound, is the most economical gasoline antioxidant in use today.*

dbpc is also supplied in easy-to-handle liquid form as Impruvol 33® antioxidant. For information write:

*2, 6 di-tert-butyl para-cresol

KOPPERS COMPANY, INC.

Chemical Division, Dept. PP-65, Pittsburgh 19, Pennsylvania

KOPPERS®

Koppers Chemicals

SALES OFFICES: NEW YORK · BOSTON · PHILADELPHIA · ATLANTA
CHICAGO · DETROIT · LOS ANGELES · HOUSTON

Branches, Distributors

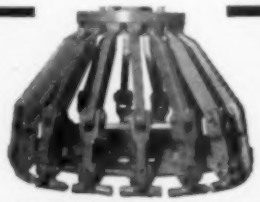
Rhodia, Inc., has appointed the Naugatuck Chemical Div. of Dominion Rubber Co., Ltd., sales and technical representative in Canada for Rhodia's industrial reodorants and line of aromatic chemicals.

Hammel-Dahl Co. has appointed Russell F. Clark Co. sales and service representatives in western Pennsylvania and part of West Virginia.

Fielden Instrument Div. of Robertshaw-Fulton Controls Co. has appointed H. J. Klug Co. representatives for Nebraska and western Iowa. Company is located at 2029 N. 67 Ave., Omaha, Neb.

Eco Engineering Co., Newark, N. J., has chosen Fischer & Porter Co., Hatboro, Pa., sales representatives for its full line of positive displacement rotary-type pumps.

Graver Water Conditioning Co., New York, has appointed Frontier Engineering Services Co., Salt Lake City, Utah, representatives in north and west Wyoming, Utah, and most of Nevada. Frontier's mailing address is P. O. Box 1772.



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Fills, seals, stamps and counts lug cover pails. Output of 15 pails per minute. Write for details on installation to meet your requirements.

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(To obtain more data on advertised products see page 916)

The most compact, reliable sampler ever built . . .

THE NEW Gilbarco

Small in size . . .
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AUTOMATIC SAMPLER

Here's a new compact, completely automatic, magnetically powered and electronically controlled sampler designed to provide a continuous sample from process or pipe lines.

USERS GET ALL THESE IMPORTANT ADVANTAGES.

- ★ Proportional to time or flow
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- ★ No hold-up time from pipe line to sample receiver; because a portion of the stream is by-passed through the sampler

Before you buy any other sampling unit, write for full details on this New Automatic Sampler.

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(To obtain more data on advertised products see page 916)

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Maximize the purity of your gas stream, and minimize corrosion problems by using Nitrogen Division gas-treating chemicals. Free of unwanted chemical impurities – chlorides and acids – these products are consistently above standard purity specifications.

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SAE Summer Meeting in Atlantic City

AUTOMOTIVE greases and chassis lubrication will receive a thoroughgoing discussion at the Society of Automotive Engineers' Golden Anniversary summer meeting. This will be from June 12 to 17 at the Chalfonte-Haddon Hall in Atlantic City.

Though not the only item on the program of interest to petroleum refiners, the greases and chassis lubrication symposium will be the longest of the sessions, featuring nine papers and four prepared discussions. It will be held on Wednesday afternoon, June 15, and led by H. L. Hemmingway, Pure Oil Co., chairman. J. W. Lane, Socony-Vacuum Oil Co., is secretary. Papers to be heard in the session follow:

"A Critical Look at Chassis Lubricants," by L. J. Kehoe, Jr., General Motors Corp.

"Test on Chassis Grease Retention," by J. B. Beltz, General Motors.

Prepared discussion by C. M. Heinen, Chrysler Corp.

"Centralized Chassis Lubrication," by C. H. Mueller, Lincoln Engineering Co.

"A Rheopectic Grease for Chassis Lubrication," by J. D. Neesley, L. C. Brunstrum, and H. J. Liehe, Standard Oil Co. (Ind.)

"Corrosion Inhibited Automotive Greases," by J. A. Bell, Shell Oil Co.

"Service Requirements for Multipurpose Automotive Greases," by J. M. Stokely, California Research Corp.

Prepared discussion: "Common Denominators for Automotive Chassis Greases," by T. G. Roehner and E. L. Armstrong, Socony-Vacuum Oil Co.

"Chassis Lubricant Performance—Driver's Reaction," by J. F. McGrogan, Atlantic Refining Co.

Prepared discussion: "A Few Physical Facts of Life About Chassis Lubricants," by J. B. Stucker, Pure Oil Co.

Prepared discussion: "The Use of Inorganic Thickeners in Grease Manufacture," by G. C. Meyer, du Pont Co.

"Fundamentals of Wheel Bearing Lubrication," by E. O. Forster and J. J. Kolfenbach, Esso Research and Engineering Co.

"Taking the Confusion Out of Wheel Bearing Lubrication," by P. V. Toffoli, Jr., National Lubricating Grease Institute.

The meeting sessions will begin on June 13 with the presentation of the Horning Memorial Award to Sir Harry Ricardo of Ricardo and Co. Engineers Ltd. Sir Harry will then give the Horning Memorial Lecture, choosing for his topic "Some Early Reminiscences."

He will be followed by a paper, "Mechanical Octanes for Higher Efficiency," by D. F. Caris, B. J. Mitchell, A. D. McDuffie, and F. A. Wyczalek, of the General Motors Research Laboratories.

In the afternoon of June 13 there will be a symposium on the stability of jet aircraft fuels. Chairman will be A. B. Crampton, Esso Research and Engineering; secretary is D. W. Bedell, Esso Standard Oil Co. Papers to be heard are as follows:

"The Effect of Composition and Storage on Laboratory Properties of Jet Fuels," by A. C. Nixon, C. A. Cole, and H. B. Minor, Shell Development Co.

"Thermal Stability—a New Frontier for Jet Fuels," by A. B. Crampton, W. W. Gleason, and E. R. Wieland, Esso Research and Engineering Co.

"Stability of Jet Fuels at High Temperatures," by C. M. Barringer, du Pont Co.

"Stability to Burn," by D. P. Heath, C. W. Hoffman, and J. H. Reynolds, Socony-Vacuum Oil Co.

On Tuesday afternoon, June 14, a round table will be held on "How to Burn Heavy Diesel Fuels," led by M. J. Anderson, Ethyl Corp. Panel members will be H. W. Barth, Cleveland Diesel Engine Div. of General Motors; C. E. Habermann, Socony-Vacuum Oil Co.; D. N. Landis, DeLaval Separator Co.; and C. C. Moore, Union Oil Co. of California.

Another session of particular interest to refiners is the round table on smog and noise reduction to be given in the afternoon of Wednesday, June 15. Leader will be Emil Gohn, Atlantic Refining Co. The panel is to consist of Fred Hague, Sun Oil Co.; L. C. Kibbee, American Trucking Assn., Inc.; A. Moreland, Fifth Avenue Coach Co.; and Robert Shertz, Greater Philadelphia Chamber of Commerce.

Ansul Chemical Holding Fire-Fighting School

Classes in fire-fighting techniques are being offered this spring and summer by the Ansul Chemical Co., Marinette, Wis. Twelve courses, each lasting three days, have been scheduled between May 23 and September 21. The Ansul test field is equipped to simulate virtually every type of fire found in industry, the company reports, and therefore students are encouraged to bring any special extinguishment problem they might have to the classes. The latest techniques of putting out fires with dry chemical agents will be included in the course.

Participants must pay their own transportation and board while at the school. The company provides the instruction and equipment.

Oil Man's Calendar

JUNE

Society of Automotive Engineers, Golden anniversary summer meeting, Chalfonte-Haddon Hall, Atlantic City, N. J., June 12-17.

16th Iowa Management Course, University of Iowa, Iowa City, June 13-25.

American Society of Mechanical Engineers, semiannual meeting, Statler Hotel, Boston, June 20-23.

American Society for Testing Materials, annual meeting, Chalfonte-Haddon Hall, Atlantic City, June 26-July 1.

JULY

2nd Western Plant Maintenance and Engineering Show, Pan Pacific Auditorium, Los Angeles, July 12-14.

AUGUST

Society of Automotive Engineers, golden anniversary West Coast meeting, Hotel Multnomah, Portland, Oregon, August 15-17.

SEPTEMBER

Petroleum Industry Conference, sponsored by the American Institute of Electrical Engineers, Houston, Sept. 12-14.

Instrument Society of America, 10th national instrument conference and exhibit, Los Angeles, Sept. 12-16.

National Petroleum Assn., annual meeting, Traymore Hotel, Atlantic City, Sept. 14-16.

Western Petroleum Refiners Assn., regional technical-industrial relations meeting, Casper, Wyo., Sept. 22-23.

American Institute of Chemical Engineers, Lake Placid Club, Lake Placid, N.Y., Sept. 25-28.

OCTOBER

American Institute of Mechanical Engineers, petroleum branch, fall meeting, Roosevelt Hotel, New Orleans, Oct. 2-5.

American Society for Testing Materials, Committee D-2, petroleum products and lubricants, Statler Hotel, Washington, D.C., Oct. 2-6.

California Natural Gasoline Assn., fall meeting, Ambassador Hotel, Los Angeles, Oct. 13-14.

American Gas Assn., annual convention, Los Angeles, Oct. 17-19.

First Congress on Petroleum, sponsored by the University of Oriente, Santiago de Cuba, Oct. 21-23.

National Lubricating Grease Institute, annual meeting, Edgewater Beach Hotel, Chicago, Oct. 31-Nov. 2.

NOVEMBER

American Petroleum Institute, annual meeting, Mark Hopkins, Fairmont, St. Francis, and Palace Hotels, San Francisco, Nov. 14-17.

American Institute of Chemical Engineers, annual meeting, Statler Hotel, Detroit, Nov. 27-30.

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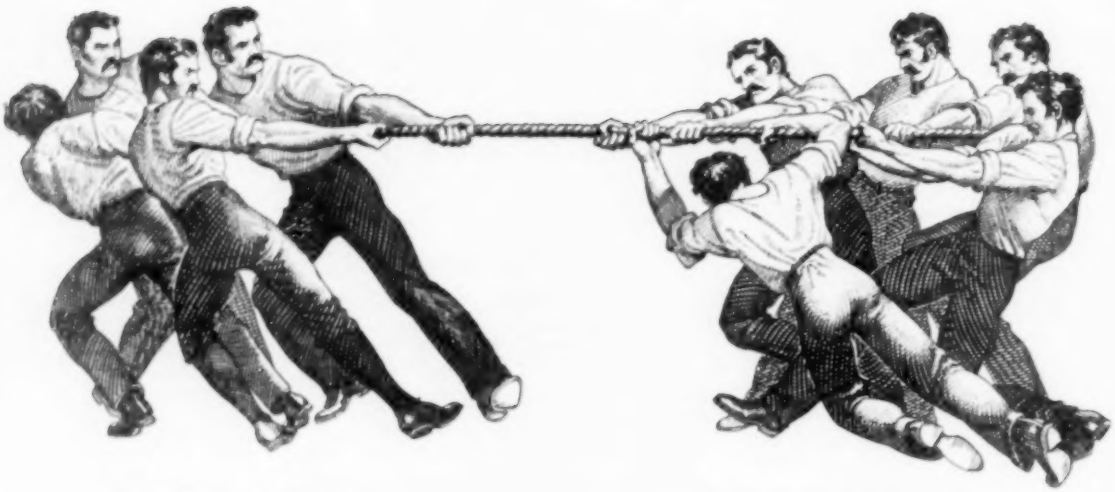

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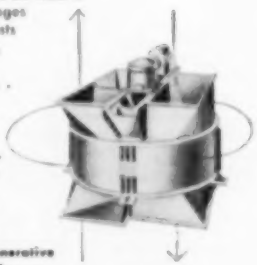

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Petroleum from Start to Finish

Modern Petroleum Technology, 2nd edition, 1954, 9 x 6¼ in., 702 pages, indexed, illustrated, stiff cloth cover, 35 shillings post free (The British Information Service advises contacting your local bank to obtain British money for the purchase of this book. The U.S. currency equivalent to 35 shillings is approximately $5.00). The Institute of Petroleum, 26 Portland Place, London, W.1, England.

DUE to the rapid progress of the petroleum industry, the first edition of this book published in 1946 has become outdated. The second edition published in 1954 has revised many articles, rewritten some, and added some material that is completely new.

Approximately thirty-three experts from Great Britain have contributed to the twenty-seven chapters covering all aspects of the petroleum industry from the search for oil to its final reduction to marketable products.

The general topics covered include those of exploration, drilling, production, distillation, cracking, petroleum chemicals, solvents, fuels, natural and cracked gases, lubricants, waxes, bitumen, transportation, oil measurement, etc.

In general the material contained in this book is descriptive, containing some operating and product data and specifications, but very little on the methods of process calculations used in the petroleum industry.

Though the material appears comprehensive, one might argue about the statement that most of the 467,000 b/d reforming capacity in the United States (1954) is thermal.

Symposium on Modern Oil Filtration Methods

Oil Filtration in Modern Industry, symposium in 2 volumes, 1954, 11½ x 9½ in., 296 pages, spiral bound, paper back, illustrated, both volumes for $2.50 postpaid in the U.S., The Department of Conferences and Special Activities, University of California Extension, Los Angeles 24, California.

That filtration of oil in gasoline and diesel engines has not kept pace with oil development, and that new ideas and research are needed, are the salient facts developed from this symposium by the American Society of Lubrication Engineers held at UCLA in February of 1954.

The fourteen papers included in this symposium deal mainly with the equipment and methods of filtering and the evaluating of filtered oil for vehicles. However, there is one comprehensive paper on lubricating oil additives—antioxidants and bearing corrosion inhibitors, detergent-dispersants, rust or corrosion inhibitors, viscosity index improvers, pour point depressants, anti-foam materials, film strength agents and dyes.

The Why and How of Lubricating Greases

Manufacture and Application of Lubricating Greases, by C. J. Boner, 1954, 9¼ x 6½ in., 977 pages, indexed, illustrated, stiff cloth cover, $18.50, Reinhold Publishing Corp., 430 Park Ave., New York 22, N.Y.

Nearly twenty years have passed since the publication of a comprehensive book on lubricating greases, during which time much progress has been made.

This new volume, *Manufacture and Application of Lubricating Greases* by C. J. Boner—Technical Director and Chief Research Chemist of the Battenfeld Grease and Oil Corp., Kansas City, Mo.—describes all aspects of greases from the theoretical to the final analysis and application.

Lubricants containing specific thickeners and additives, including such new developments as lithium soap, complex soaps, and non-soap gelling agents, receive detailed attention.

Special emphasis is placed on the effect of each grease ingredient or treatment upon the characteristics of the final product, and methods of evaluating these characteristics by either chemical or physical means.

A partial list of contents—to illustrate subject matter contained—includes structure and theory; additives; raw materials; manufacturing processes and equipment; aluminum, barium, calcium, lithium, sodium, lead strontium, miscellaneous metal and mixed base lubricating greases; complex soap greases; non-soap thickeners; fillers; residua and petrolatums as lubricants; analysis of greases; tests of greases and their significance; application of greases; and trends in lubricating greases.

Recent Books Briefly Noted

Minerals Yearbook—Fuels—Vol. II, 1952, 9¼ x 6 in., 450 pp., illustrated, index, cloth cover, $2.25, Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C.

. . . devoted to mineral fuels with reviews of the industry, commodity reviews for coal and related products, helium, also including asphalt, carbon black, natural gas, natural gas liquids, petroleum and petroleum products and covering production, employment, injuries, technologic developments, and problems.

Air Pollution, a Bibliography, Bureau of Mines Bulletin 537, $1.75, Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C.

. . . on outdoor air pollution with 3900 references to air pollution from scientific literature as prepared by the Bureau of Mines.

Oil and Petroleum Year Book, compiled by Walter E. Skinner, 1954 edition, 8 x 5½ in., 350 pp., index, cloth cover, $5.00—post free, Walter E. Skinner, 20 Copthall Ave., London, E.C.2, England.

. . . with complete and up-to-date particulars for 945 companies operating in all parts of the world and covering all branches of the oil industry, together with a list of names and addresses of 628 managers and engineers and their company affiliations; includes directors, description, where operating, crude oil production, refinery runs, capital details, dividends, and financial results—also containing 875 references to manufacturers of oilfield and refinery equipment.

Statistical Analysis In Chemistry and the Chemical Industry, by Carl A. Bennett and Norman L. Franklin, 1954, 9 x 6 in., 724 pp., illustrated, index, cloth cover, $8.00, John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N.Y.

. . . begins with fundamentals of statistics, dealing with each phase as completely as possible, detailing theoretical background and derivation of analytical methods and computational procedures with examples from the chemical field and references to other works.

Product Flow Charts of the United States Chemical Industry, from the Chemical Economics Handbook, Nov., 1954, 11 x 9 in., 16 pp. with 7 charts, spiral binding, heavy paper cover, $5.00, Stanford Research Institute, Stanford, Calif.

. . . contains product flow charts for organic and inorganic industries, tracing each raw material through intermediates to end-chemicals and end-uses, listing all organic chemicals with production volume more than 25,000,000 lbs. or $5,000,000, and all

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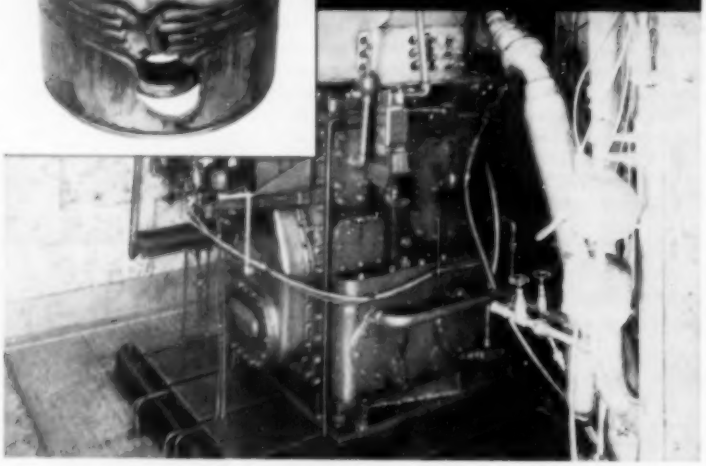

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(To obtain more data on advertised products see page 916)

inorganic chemicals of more than 50 million lbs. or $5 million in 1953, plus some others expected to reach this volume soon.

Supplements 1 & 2 to API Standard 610 (Specification for Centrifugal Pumps for General Refinery Services), $0.25 each, American Petroleum Institute, 50 W. 50th St., New York 20, N. Y.

. . . Supplement 1 pertains to mechanical shaft seals for use in centrifugal pumps for general refinery service, covering the design and suitable materials for specified pump service conditions; Supplement 2 covers vertical process pumps to make it applicable to vertical process pumps including single and double-casing types.

What Every Engineer Should Know About Rubber, by W. J. S. Naunton, 9 x 5½ in., 128 pp., cloth cover, illustrated, index, $0.50, published by British Rubber Development Board, London, England, obtain from the Natural Rubber Bureau, 1631 K St., N.W., Washington 6, D. C.

. . . written as a "how-to" working tool for engineers covering the production of rubber, its properties, technology, uses in engineering, testing, and specifications.

Symposium on Color of Transparent, Translucent Products, 1955, ASTM Committee E-12, 11 x 8½ in., 32 pp., heavy paper cover, table of contents, $2.00, American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa.

. . . published with the object of revealing unevenness in the development and use of colorimetric methods; covers determination of color in petroleum products, grading, brewing industry, agricultural products, transparent liquids for surface coatings, and dairy products.

Synthetic Rubber, edited by G. S. Whitby, Sept. 1954, 9 x 6 in., 1044 pp., illustrated, index, cloth cover, $18.00, John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y.

. . . prepared under the auspices of the Division of Rubber Chemistry of the American Chemical Society with contributions by 28 authorities on history, methods of manufacture, polymerization, compounding, testing, uses, etc.

Minerals in World Industry, by Walter H. Voskuil, 1955, 9 x 6½ in., 324 pp., illustrated, indexed, stiff cloth cover, $5.75, McGraw-Hill Book Co., 330 W. 42nd St., New York 36, N. Y.

. . . primarily concerned with the part played by minerals in economic productivity and a high standard of living, begins with iron as the core of the productive society based on minerals and goes on to consider fuels—coal, petroleum, natural gas, and "alternative fuels"—with attention to international political aspects of mineral resources.

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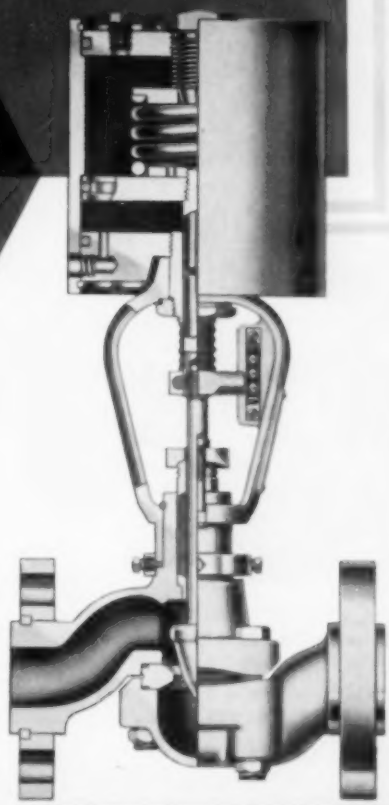

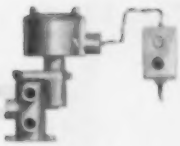

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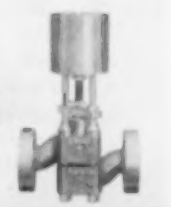

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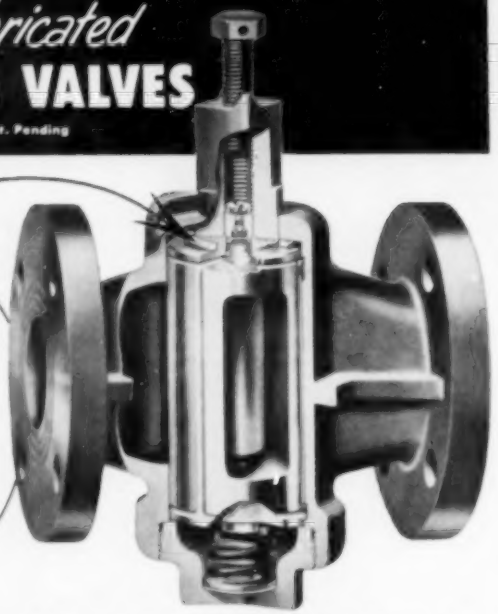

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Books

Flammable Liquid Trade Name Index, NFPA No. 324A, 82 pp., $1.25, National Fire Protection Association, 60 Batterymarch St., Boston 10, Mass.

. . . with compilation of flash points of more than 2400 flammable liquid trade name products to assist in the safe storage and use of flammable liquids, also identifying each product as to its principal uses, manufacturer, and the NFPA's source of information about it.

Michael Tswett's First Paper on Chromatography, by Gerhard Hesse and Herbert Weil, 1954, 8 x 6 in., 35 pp., illustrated, table of contents, paper cover, $2.00, Alupharm Chemicals, 54 C St., Elmont, L. I., New York.

. . . translation of the original Russian publication in 1903 describing early and effective experiments in the chromatographic method of analysis.

Symposium on Odor, ASTM Special Technical Publication No. 164, Nov. 1954, 9 x 6 in., 88 pp., table of contents, illustrated, heavy paper cover, $2.25, American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa.

. . . six papers resulting from work by ASTM Committee D-22 on atmospheric Sampling and Analysis covering a proposal for basic definitions, catalytic method of measuring hydrocarbon concentrations in exhaust fumes, the design, construction and use of an odor test room, odor control methods, and others.

Symposium on Effect of Cyclic Heating and Stressing on Metals at Elevated Temperatures, ASTM Special Technical Publication No. 165, Oct. 1954, 9 x 6 in., 184 pp., table of contents, illustrated, heavy paper cover, $3.00, American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa.

. . . eight papers covering situations involving relatively slow changes in stress or temperature or both for design considerations in creep, thermal stress fatigue, temperature cycling, rupture strength, creep rupture, and scaling of Fe-Cr-Ni alloys of different compositions in cyclic temperature service.

Directory of Commercial and College Testing Laboratories, 1955, 10½ x 8 in., 48 pp., paper cover, $1.00, American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa.

. . . this compilation previously made by the National Bureau of Standards is now the responsibility of the ASTM, listing locations and information on 278 commercial testing laboratories and their 151 branches or offices, and 86 colleges prepared to do testing under certain conditions, but does not include research and consulting laboratories unless they also perform commercial testing.

(To obtain more data on advertised products see page 916)

Davison M-S®

HIGH ALUMINA Catalyst

DAVISON GIVES YOU HIGH ALUMINA CATALYST IN THE PARTICLE SIZE BEST SUITED FOR YOUR UNIT!

HIGH ALUMINA M-S CATALYST PARTICLE SIZE DISTRIBUTION

The catalyst with a minimum of fines . . .

Grade	F-3-25 Extra Fine	F-2-25 Fine	F-1-25 Inter-mediate	C-1-25 Coarse	C-2-25 Extra Coarse
Size range by C.A.E.: Wt. %					
0-10 Microns	4	2	1	1	1
0-20 Microns	9	4	2	2	2
0-30 Microns	16	11	6	5	4
0-40 Microns	28	21	12	10	8
. . . and a minimum of coarse particles					
Sieve analysis: Wt. %					
on 100 mesh (149 microns)	0	0	1	1	1
on 140 mesh (104 microns)	1	1	4	6	8
on 200 mesh (74 microns)	4	5	15	22	33

Now Davison has taken the characteristics of High Alumina Catalyst and combined them with the proven advantages of its 13% Alumina Catalyst. This gives you, for the first time, High (25%) Alumina Catalyst with *all* these qualities:

- ***Lower Stack Losses***
- ***Better Maintenance of Activity and Surface Area***
- ***Narrow Particle Size Distribution***
- ***High Attrition Resistance***
- ***High Purity and Uniformity***

For information on Davison High Alumina Catalyst see your Davison Representative or write.

Progress Through Chemistry

DAVISON CHEMICAL COMPANY

Division of W. R. Grace & Co.

Baltimore 3, Maryland

Sales Offices: Chicago, Ill.; Houston, Tex.; New York, N. Y.; Baltimore, Md.

PRODUCERS OF CATALYSTS, INORGANIC ACIDS, SUPERPHOSPHATES, TRIPLE SUPERPHOSPHATES, PHOSPHATE ROCK, SILICA GELS AND SILICOFLUORIDES. SOLE PRODUCERS OF DAVCO® GRANULATED FERTILIZERS.

Information Offered in the Advertisements

ANNUAL REPORT of Standard Oil Co. (New Jersey) available; Standard Oil Co. (New Jersey). See adv't. p. 925.

BARIUM CHEMICALS, products handbook; Westvaco Mineral Products Div. See adv't. p. 919.

BUBBLE CAPS, 300 styles, bulletin 22; Pressed Steel Co. See adv't. p. 924.

CATALYSTS, available in 7 forms, booklet; Harshaw Chemical Co. See adv't. p. 832.

CHEMICAL FEEDERS, for waste treatment, bulletin B-I-F 4A; Omega Machine Co. See adv't. 2nd cover.

CLAY, for protection against platinum catalyst poisoning, booklet; Minerals & Chemicals Corp. of America. See adv't. p. 865.

CLEANING COMPOUNDS, for drums, tanks, etc., handbook; Oakite Products, Inc. See adv't. p. 936.

CONDUIT, aluminum, rigid, factbook; Alcoa Aluminum. See adv't. p. 902.

COOLING TOWERS, air only and air and water combined, booklet; Hudson Engineering Corp. See adv't. pp. 820A-820B.

COOLING TOWERS, air cooled, bulletin R-355; Santa Fe Tank & Tower Co., Inc. See adv't. 4th cover.

CORROSION PROTECTION, "Alumicoat," descriptive folder; Arthur Tickle Engr. Works, Inc. See adv't. p. 901.

DEMISTERS, various types and sizes, catalog and technical literature; Otto H. York Co., Inc. See adv't. pp. 830-831.

DRYING EQUIPMENT, for air, gases and organic liquids, literature; Pittsburgh Lectrodryer Corp. See adv't. p. 789.

ENTRAINMENT SEPARATORS, hi-thruput, booklet ME-5; Metal Textile Corp. See adv't. p. 933.

FLOATING ROOFS, double pontoon, manual WP-14; Gen'l. American Trans. Corp. See adv't. p. 770.

FLOOR MAINTENANCE, polishers and scrubbers, literature; Lincoln-Schlueter Floor Mach. Co. See adv't. p. 928.

GAS ANALYSIS, by adsorption, booklet 83; Burrell Corp. See adv't. p. 932.

HEAT ENCLOSURES, all types, booklet; M. H. Detrick Co. See adv't. p. 828.

HEAT EXCHANGERS, air cooled, bulletin 120; Niagara Blower Co. See adv't. p. 894.

IGNITER, portable, for gas fired furnaces, literature; John Zink Co. See adv't. p. 810.

INSULATION, "Foamglas," cellular, information; Pittsburgh Corning Corp. See adv't. p. 935.

INSULATION, industrial, booklet; Armstrong Cork Co. See adv't. p. 816.

INSULATION, industrial, magnesia, catalog; Philip Carey Mfg. Co. See adv't. p. 803.

JOINTS, ball, swing and strut, bulletin 28; Barco Mfg Co. See adv't. p. 930.

LIQUID DENSITY, measurement and control, bulletin W-3; Precision Thermometer & Inst. Co. See adv't. p. 892.

MECHANICAL SEALS, complete catalog; Durametallic Corp. See adv't. p. 933.

MIXING AND BLENDING equipment, 8 catalogs and data sheets; Mixing Equipment Co. See adv't. p. 836.

MIXERS, agitators and kneading machines, literature; Struthers Wells Corp. See adv't. p. 898.

MOTOR STARTERS, for hazardous locations, booklet 1062; Electric Controller & Mfg. Co. See adv't. p. 827.

OXYGEN ANALYZERS, for process operations, data file 15 J-65; A. O. Beckman, Inc. See adv't. p. 922.

PACKING, "Teflon," for pumps and valves, catalog TP-1053; U. S. Gasket Co. See adv't. p. 783.

PAINT, aluminum, corrosion resistant, booklets; Alcoa Aluminum. See adv't. p. 823.

PROCESS ANALYZERS, refractometer and infrared analyzer, bulletins CEC 1840-X3 and CEC 1839-X3; Consolidated Engr. Corp. See adv't. p. 821.

PROCESS EQUIPMENT, steel fabrication, general catalog; Flint Steel Corp. See adv't. p. 892.

PROCESS EQUIPMENT, aluminum, booklet; Alcoa Aluminum. See adv't. pp. 814-815.

PROCESS EQUIPMENT, all types, catalog 356-R; Blaw-Knox Co. See adv't. p. 937.

PUMPS, centrifugal, new catalog; Eastern Industries, Inc. See adv't. p. 772.

PUMPS, for slurries and sludge, bulletin 207-4; Lawrence Pumps, Inc. See adv't. p. 938.

REFINERY CONSTRUCTION, and design, booklet; Kuljian Corp. See adv't. p. 934.

REFINERY EQUIPMENT, fabricated from aluminum, literature; Washington Aluminum Co. See adv't. p. 924.

REFINERY FABRICATION, brochure, Kaiser Engineers. See adv't. p. 921.

SAMPLER, automatic, electronic control, literature; Gilbert & Barker Mfg. Co. See adv't. p. 905.

SPEED CONTROL, pneumatic, automatic, bulletin B-50-2; Conoflow Corp. See adv't. p. 886.

STAINLESS STEEL, for refinery applications, booklet; U. S. Steel Corp. See adv't. p. 811.

STEAM TRAPS, various types, booklet; Armstrong Machine Works. See adv't. p. 890.

TEMPERATURE RECORDERS, 3 standard types, catalog; Electric Auto-Lite Co. See adv't. p. 897.

TERMINAL FACILITIES, illustrated booklet; Hess Terminal Corp. See adv't. p. 891.

TUBE FITTINGS, welding type, steel, catalog; Parker Appliance Co. See adv't. p. 929.

TUBE MAINTENANCE, expanders, information; Airetool Mfg. Co. See adv't. p. 880.

TUBE ROLLERS, and expanders, bulletin 3400; Gustav Wiedeke Co. See adv't. p. 897.

TUBES, condenser and boiler, catalog and booklet; Wolverine Tube. See adv't. pp. 828A-828B.

TUBING, pressure, all sizes, technical bulletin 329PP; Babcock & Wilcox Co. See adv't. p. 807.

TURBINES, vertical, catalog 500; Dean Hill Pump Co. See adv't. p. 927.

VALVES, compression shut-off, catalog 55-B; Orbit Valve Co. See adv't. p. 923.

VALVES, for instrument piping, data available; Jerguson Gage & Valve Co. See adv't. p. 897.

VALVES, lubricated plug, reference book 39-5; Homestead Valve Mfg. Co. See adv't. p. 912.

VALVES, steel, gate, literature; Crane Co. See adv't. p. 794.

VALVES, toggle, small sizes, catalog and data sheets; Hoke, Inc. See adv't. p. 901.

CLASSIFIED

UNDISPLAYED RATE

$1.50 a line. Minimum 3 lines. To figure advance payment count 5 average words as a line. (see ¶ on Box Numbers.)
POSITION WANTED. Undisplayed rate is one half of above rate, payable in advance.
PROPOSALS, $1.50 a line an insertion.

INFORMATION:

BOX NUMBERS count one additional line in undisplayed ads.
DISCOUNT OF 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

DISPLAYED RATE

The advertising rate is $13.50 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request. AN ADVERTISING INCH is measured ⅞ inch vertically on one column, 3 columns—30 inches—to a page.

Send NEW ADVERTISEMENTS to Classified Advertising Division, PETROLEUM PROCESSING, *330 W. 42 St., N. Y. 36, N. Y.*
SECTION CLOSES June 14th for July issue.

All items listed subject to prior sale or use by Eli Lilly and Company.

9—Podbielniak, Type 316 S.S. centrifugal, multistage, counter-current liquid-liquid solvent extractors. 1 Serial #6060, 8 Serial #6070. Engineering data available. Original cost 1947—$12,500 ea. Used. Price $2,500 ea.

1—Buffalo Vac 12" x 18" Drum Drier S.S. Blade and Drum. Used. Price $1,500

3—Devine single door vacuum shelf driers. 6 shelves, 9" apart. 80 square feet effective pan surface. Drawing available. Replacement cost $5,500 ea. New. Price $2,500 ea.

1—Dunn Brothers Pump 7 x 7 x 10 Duplex Double Acting Piston Type Pump. Durable S.S. Valve Service. Replacement cost $1,200. New. Price $600

3 Polar Stills, 3 Rotameters, 1 Tapered Tantalum condensor, 1 Copper condensor 24 square feet, 1 Tilting kettle on casters 200 gallon.

All items F.O.B. Indianapolis.

ELI LILLY AND COMPANY

Plant Salvage Department — John H. Compton
740 S. Alabama Street, Indianapolis 6, Indiana
MElrose 6-2211

PERSONNEL MANAGERS

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Write for free copy of

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The engineers and technicians you want to reach are gathered in convenient, compact groups—as this 12-page booklet points out.

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Write for your free copy to

Classified Advertising Division
PETROLEUM PROCESSING
330 W. 42nd St., N. Y. 36, N. Y.

THE STANDARD OIL COMPANY (OHIO)

Manufacturing (Refining) Department

is looking for

CHEMICAL ENGINEERS, CHEMISTS, and MECHANICAL ENGINEERS

with one to five years experience in petroleum refining or related activities

for staffwork primarily in Cleveland, Ohio.
Possible employment in Toledo, Lima, or Cincinnati, also.

Applicant should have the following educational background and industrial experience:

Chemical Engineers: B.S. or higher degree and experience in development, pilot plant operation, process design, process trouble shooting, refinery process engineering, economic studies, or related work background.

Chemists: B.S. or higher degree and experience in product and process research or development.

Mechanical Engineers: B.S. or M.S. degree and experience in process equipment construction, design, inspection, or maintenance, petroleum product testing and field evaluation, or related work background.

Age range 22 - 32

Salaries commensurate with experience and level in organization. Advance on merit basis.

If you can qualify and are looking for a permanent job with a growing but secure midwest company, write, giving full information on education, industrial experience, military experience, and personal data to E. G. Glass, Jr., 1737 Midland Building, Cleveland 15, Ohio.

PROCESS ENGINEER

Experienced in design, engineering and supervising operations of carbon black plant employing oil black process.

Interviews arranged on basis of complete chronological resume, including education & employment (names & addresses of employers, dates employed, salaries received, positions held, including your specific duties & scope of responsibility).

All replies are confidential.

P6559 Petroleum Processing
330 W. 42 St., N. Y. 36, N. Y.

OPERATING ENGINEER

NEW YORK OFFICE

To assist in supervising office & field and domestic & foreign activities of the Operating Department. Challenging opportunity for graduate chemical or mechanical engineer with minimum five years petroleum refining experience, preferably with contracting engineering firm.

Please airmail confidential verifiable chronological resume, including salary history, to

PERSONNEL DEPARTMENT
HYDROCARBON RESEARCH, INC.
115 Broadway — New York 6, N. Y.

ADVERTISERS' INDEX

This index is published as a convenience to the reader. Every care is taken to make it accurate, but PETROLEUM PROCESSING assumes no responsibility for errors or omissions.

FOR INFORMATION ON ANY PRODUCT OR SERVICE ADVERTISED IN THIS ISSUE SEE INSTRUCTIONS BELOW

Each advertiser listed in this index has been assigned a code letter for use by the reader in securing additional information about advertised products, or services which interest him. This code letter appears in parentheses to the left of the advertiser's name.

Circle the code letter on the "Advertised Product Inquiry" card (on the page opposite) which corresponds to that assigned the advertiser about whose product you want further information.

Fill in your name, title, company and mailing address and mail the card . . . no postage is required.

The Petroleum Processing Reader Service Department will give your inquiries prompt and efficient handling.

(A-1) Airetool Mfg. Co. 880
(A-2) Air Preheater Corp. 908
(A-3) Alamask Div., Rhodia, Inc. 940
(A-4) Aluminum Co. of America, Electrical Products Div. 902
(A-5) Aluminum Co. of America, Pigments Div. 823
(A-6) Aluminum Co. of America, Process Equipment Div. 814-815
(A-7) American Cyanamid Co., Refinery Chemicals Dept. 782
(A-8) Anaconda Copper Mining Co. 778
(A-9) Annin Co. 911
(B-1) Armstrong Cork Co., Inc. 816
(B-2) Armstrong Machine Works 890
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(B-4) Babcock & Wilcox Co., Boiler Div. 784
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Classified Advertising

F. J. Eberle, Ass't. Mgr.

EMPLOYMENT
Positions Vacant 915
EQUIPMENT
(Used or Surplus New)
For Sale 915

SAVE TIME • SAVE EFFORT • KEEP INFORMED

USE THIS CARD . . .

to secure information on products and services advertised in *Petroleum Processing* or reviewed in its *"What's New"* section.

FOR ADVERTISED PRODUCT INFORMATION:
Check the Advertiser's Index for advertisement's code letter. Then circle the corresponding code letter on the card below.

FOR "WHAT'S NEW" PRODUCT INFORMATION:
Circle the code number on the card below which corresponds to the number listed at the end of that specific "What's New" item.

THEN:
Fill in your name, position, company and mailing address. Mail the card . . . no postage is required.

PETROLEUM PROCESSING READER SERVICE INFORMATION CARD—VOID AFTER SEPTEMBER 15, 1955

"WHAT'S NEW" ITEMS

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A2	B2	C2	D2	E2	F2	G2	H2	I2	J2	K2	L2	M2	N2	O2	P2
A3	B3	C3	D3	E3	F3	G3	H3	I3	J3	K3	L3	M3	N3	O3	P3
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A6	B6	C6	D6	E6	F6	G6	H6	I6	J6	K6	L6	M6	N6	O6	P6
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A9	B9	C9	D9	E9	F9	G9	H9	I9	J9	K9	L9	M9	N9	O9	P9

PETROLEUM PROCESSING
A McGRAW-HILL PUBLICATION

6/55

Name (Please Print) _____ Position _____

Company _____ Business Address _____

City, Zone _____ State _____

PETROLEUM PROCESSING READER SERVICE INFORMATION CARD—VOID AFTER SEPTEMBER 15, 1955

"WHAT'S NEW" ITEMS

1	2	3	4	5	6	7	8
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25	26	27	28	29	30	31	32
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ADVERTISED PRODUCTS

A1	B1	C1	D1	E1	F1	G1	H1	I1	J1	K1	L1	M1	N1	O1	P1
A2	B2	C2	D2	E2	F2	G2	H2	I2	J2	K2	L2	M2	N2	O2	P2
A3	B3	C3	D3	E3	F3	G3	H3	I3	J3	K3	L3	M3	N3	O3	P3
A4	B4	C4	D4	E4	F4	G4	H4	I4	J4	K4	L4	M4	N4	O4	P4
A5	B5	C5	D5	E5	F5	G5	H5	I5	J5	K5	L5	M5	N5	O5	P5
A6	B6	C6	D6	E6	F6	G6	H6	I6	J6	K6	L6	M6	N6	O6	P6
A7	B7	C7	D7	E7	F7	G7	H7	I7	J7	K7	L7	M7	N7	O7	P7
A8	B8	C8	D8	E8	F8	G8	H8	I8	J8	K8	L8	M8	N8	O8	P8
A9	B9	C9	D9	E9	F9	G9	H9	I9	J9	K9	L9	M9	N9	O9	P9

PETROLEUM PROCESSING
A McGRAW-HILL PUBLICATION

6/55

Name (Please Print) _____ Position _____

Company _____ Business Address _____

City, Zone _____ State _____

FOR MORE INFORMATION...

about products and services advertised in this issue of Petroleum Processing or reviewed in its "What's New" section, use the postage-free cards provided below.
(See other side for complete instructions.)

FIRST CLASS
PERMIT NO. 64
(Sec. 34.9 P. L. & R.)
New York, N. Y.

BUSINESS REPLY CARD
No Postage Necessary If Mailed in the United States

4c-POSTAGE WILL BE PAID BY

PETROLEUM PROCESSING

330 WEST 42nd STREET

NEW YORK 36, N. Y.

FIRST CLASS
PERMIT NO. 64
(Sec. 34.9 P. L. & R.)
New York, N. Y.

BUSINESS REPLY CARD
No Postage Necessary If Mailed in the United States

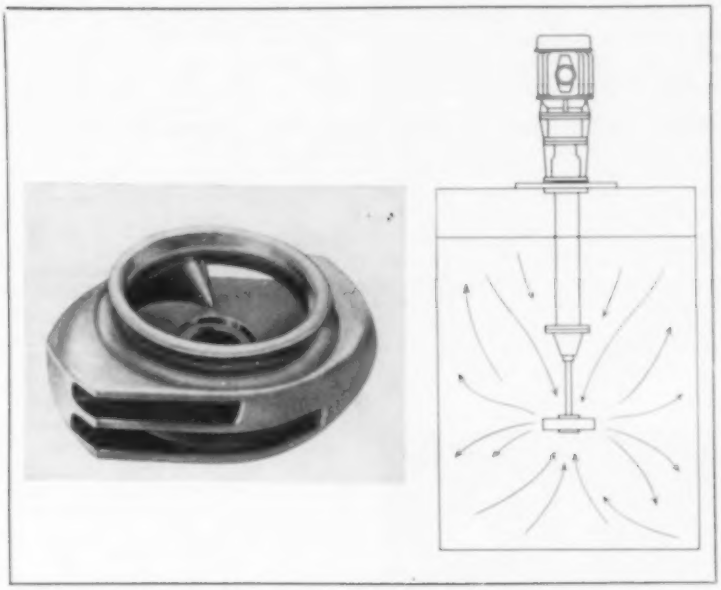
4c-POSTAGE WILL BE PAID BY

PETROLEUM PROCESSING

330 WEST 42nd STREET

NEW YORK 36, N. Y.

WHAT'S NEW...



Centrifugal Action Liquid Mixer

A liquid mixer which operates on the principle of a centrifugal pump is now available. The "Rheinhuette" (German) mixer operates with a special impeller which is rotated rapidly so that liquid is sucked from both top and bottom of the impeller and driven out radially at different velocities toward the sides.

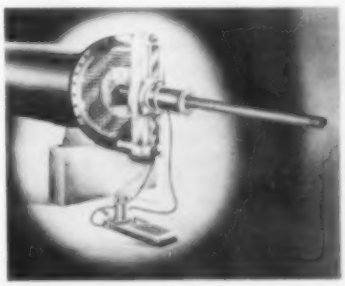
The mixing impeller is a roughly oval block with one circular opening at the top and another on the bottom, each connected by curved channels to slots on the sides. During rotation, centrifugal force drives liquid radially through the slots—liquid then flows into the openings at top and bottom of the impeller to replace the liquid driven out. As the impeller rotates more rapidly, the suction at the top and bottom increase so that heavy liquids or solids are drawn from the bottom of the mixing container and lighter liquids are drawn down from the top.

The Rheinhuette mixer is recommended for liquid-gas, liquid-solid, miscible and immiscible liquids, and other difficult mixing jobs. U. S. representative for the mixer is Neumann & Weaver, Inc., 22-12 Raphael St., Fair Lawn, N.J.

Circle No. **1** *on Reply Card*

For More Information

Use one of the attached reply cards to request additional details or literature on any items reviewed in "What's New!" Just circle the numbers corresponding to the numbers at the end of each item in which you are interested. Then fill in the rest of the card and drop it in the mail. No postage is required.



Hydraulic Bundle Mover

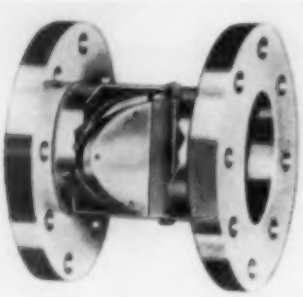
. . . speeds bundle handling and reduces safety hazards. The "Hydro-ejector" can be operated by two men to push a bundle eight feet in less than 25 minutes. Accurate alignment allows the largest bundles to be moved rapidly with the 12,000 lbs. force exerted by the device without the bundles sticking. No temporary steel structures are required to withstand the thrust as the Ejector is attached directly to the exchanger shell. The "Hydro-ejector" is available ready for operation as a packaged unit including pump, hose, adjustable yoke, ram, tie rods, cable and all other equipment needed. The Fabricated Products Div., The M. W. Kellogg Co., 225 Broadway, New York, N. Y.

Circle No. **2** *on Reply Card*

Electronic Computer

. . . is moderately priced and capable of solving lengthy, complex problems of research and engineering. The computer incorporates a two command structure providing for addition, subtraction, multiplication and division as well as branching and other logical operations. Standard input and output devices include an electric typewriter, a photo-electric tape reader and a mechanical tape punch. Accessory magnetic tape units are available for additional storage or input and output purposes. As many as four tape units may be used to store an additional 600,000 words, and auxiliary equipment is available to permit use of punch cards and an incremental graph plotter. Etched circuits and plug-in units simplify maintenance. The castor mounted cabinet is 27 in. wide, 30 in. deep, and 60 in. high. Single phase power requirements are only 3 KVA. Bendix Computer, 5630 Arbor Vitae St., Los Angeles 45, Calif.

Circle No. **3** *on Reply Card*



New Fluid Check Valve

. . . **features long life** while operating in high or low pressure gas, water, vapor, gasoline and other fluid lines. The "Technocheck" gives positive automatic opening and closing on low pressure differentials, and is designed without a valve seat—the valve body is utilized for this purpose—to permit unrestricted straight-line flow. Operation is silent, and with discharge from compressor, blower, or pumps, valve elements assume streamlined position and allow free flow. Materials available include steel, bronze, cast iron, aluminum, stainless steel, and other alloys. Standard valves operate up to 50 psi. and 200° F., with special models available for up to 500° F. and 400 psi. Techno Corp., 16-30 West 5th St., Erie, Pa.

Circle No. **4** *on Reply Card*

Molecular Filter

. . . **speeds lab analyses** by permitting filtration rates up to 250 ml./hr.—claimed to be more than 100 times the rate possible with comparable types of laboratory filters. It separates large sized molecules, filterable viruses, pyrogens, etc., directly from solution with no further chemical or heat treatment required. Lab technicians with pressure filtration training can use the filter. Its high filtration rate is from using a cellulosic membrane approximately 1½ thousandths in. thick in the form of a long tube with fine pores —around 10 millimicrons. The tube is protected by a strong cotton braided tube so that liquid can be forced through at up to 100 psig. The filter is supplied as a cartridge for easy replacement. Though for lab use now, future plans are for units large enough to pilot plants and industry. The Emil Greiner Co., 20-26 N. Moore St., New York 13, N. Y.

Circle No. **5** *on Reply Card*

Process Refractometer

. . . **measures liquids continuously** in process streams. One of four plant-type analytical instruments acquired from Phillips Petroleum Co., the refractometer (described in "Are Process Analyzers for You?", PETROLEUM PROCESSING, pages 204 to 210, February, 1955) has been used for the automatic control of liquid stream blending and fractionating tower operation. Operation is by the measurement of the difference in refractive index between a sealed-in liquid standard and a flowing sample from the process line. Measurement is based on the relative bending effects of the sample and standard on a light ray. Beam deflection is measured by an optical servo system. A telemetering circuit for strip or circular chart recording, or direct control, is provided by a potentiometer geared to the servo motor shaft. Floor space requirement is 4 x 6 ft. An explosion-proof bell mount is provided for the refractometer. Power requirement is less than 100 watts of 115-volt a-c. Sensitivities of 0.000012 R.I. Units per division down to 0.0024 R.I. Units per division are available. Consolidated Engineering Corp., 300 N. Sierra Madre Villa, Pasadena 15, Calif.

Circle No. **6** *on Reply Card*

Safety Solvent

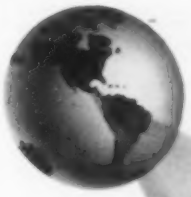
. . . **replaces carbon tetrachloride** in cleaning operations. "Turco-Solv" can be used to remove grease, oil and carbon film, yet is non-explosive, and has a flash point over 200° F., TCC. The solvent does not contain any carbon tetrachloride or toxic chlorinated solvents. It is non-conductive allowing some electrical equipment to be cleaned in place, and evaporates rapidly from cleaned parts. Turco Products, Inc., 6135 S. Central Ave., Los Angeles 1, Calif.

Circle No. **7** *on Reply Card*

Rotary Airlock

. . . **feeds catalysts** and other materials such as carbon black in high or low pressure systems. It seals off air at the bottom discharge of spray dryers, dust collectors and bag filters. It will feed any kind of powdered or granular product into pneumatic conveying lines, and will function as a working seal to sustain differential pressures. With variable speed transmission, the feeder can feed continuously at a predetermined rate or can be instantly increased or decreased. Can be made of bronze or 304 stainless steel with from ½ to ¾ hp. motors. Prater Pulverizer Co., 1515 S. 55th St., Chicago 50, Ill.

Circle No. **8** *on Reply Card*



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Chlorinated Polymer

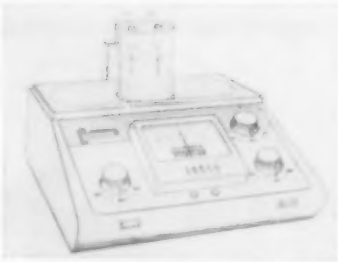
. . . **resists corrosion** from liquids used in the petroleum and chemical industries. Called "Polypenco K-51," it is furnished in rod form claimed to combine mechanical strength, high temperature resistance, chemical resistance, dimensional stability and free machinability. Tests have indicated promise for use as bearings, rollers and gears under corrosive conditions, as well as pump impellers, valve seats, gaskets, packing, etc. Water absorption is zero. Reagents resisted by the polymer include hydrochloric acid, sulfuric acid, nitric acid, chromic acid, acetone, acetophenone, ammonium hydroxide, aniline, ethyl acetate, ethyl ether, ethylene dichloride, furan, heptane, hydrogen peroxide, toluene, and distilled water. Available in rods up to 2-in., larger rods and other shapes—strip, slab, tubing, etc.—will be offered in future. The Polymer Corp. of Penna., Reading, Pa.

Circle No. **9** *on Reply Card*

Viscosity Measurement

. . . **is accurate** for small samples at high flow rates. The new "Model 500 Castor-Severs Micro-Rheometer" is offered as the only instrument available for measuring viscosity in small quantities of material. With a capacity of 7/10-ml., it will handle as little as 1/10-ml. of liquid. Also featured are a temperature range from room to 300° C., and a pressure range from 0 to 3000 psi., a standard nitrogen cylinder and an excellent pressure source. Viscosities can be determined accurately from one centipoise to 5 billion centipoises. One of a line of seven Rheometers, it is a self-contained, unit-package instrument delivered ready for use. Burrell Corp., 2223 Fifth Ave., Pittsburgh 19, Pa.

Circle No. **10** *on Reply Card*



Mercaptan Determination

. . . **is automatic** using coulometric titrator. Designed for analyzing mercaptan sulfur content in petroleum stocks and other organic liquids, the instrument was developed by the Standard Oil Co. (Ind.). In operation a 1-ml. sample is placed in a beaker with two sets of electrodes — one coulometric for generating silver ions, the other amperometric for end point detection. Silver ions begin reacting with mercaptans in the sample until at the end point an excess of silver ions causes the current to increase between amperometric electrodes and stops the titration. The time of titration indicates the mercaptan content. For samples with over 100 micrograms mercaptan sulfur, accuracy is better than 2% agreement with potentiometer results. Central Scientific Co., 1700 Irving Pk. Rd., Chicago, Ill.

Circle No. **11** *on Reply Card*

Digital Computer

. . . **is for small companies** with large computational requirements. The "ALWAC III" is versatile and simple to operate. Utilizing magnetic drum memory storage for 4096 words, 8192 storage drums are available. Final results of computations are printed out with form control, signs, decimal points, and alphabetical headings completely under control of a sequence of instructions permanently stored on the magnetic drum. Components consist mainly of 6 basic plug-in assemblies. A Flexowriter with punched tape input-output is used, with auxiliary equipment consisting of IBM conversion units for 100 cards per minute. Multiple electric typewriters can be connected to the machine at remote locations. Housed in three cabinets and weighing a total of 2200 lbs., it requires 125 in. by 28 in. floor space and 5 kw power at 110 or 220 volts a-c. Logistics Research Inc., 141 So. Pacific Ave., Redondo Beach, Calif.

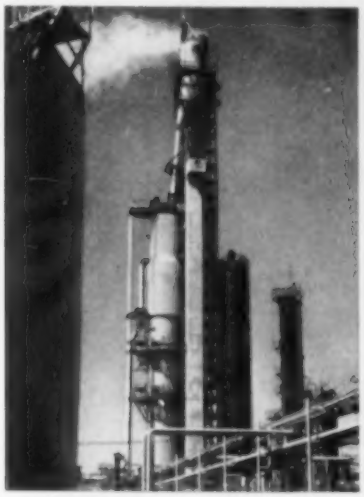
Circle No. **12** *on Reply Card*

Stainless Surface Alloy

. . . **has chromium diffused** into ferrous metals to form an alloy surface to depths from 0.001-in. to 0.008-in. The process allows ferrous metals to resist corrosion, thermal oxidation up to 1700°F., and abrasion. The surface will not chip, crack, peel or gall even when the processed product is bent 180°, stretched or twisted. Products can be welded before or after processing using proper procedures, as well as brazed, arc welded and spot welded. Specification grey iron, malleable iron castings and meehnite can be treated with chromium diffusion as well as other ferrous metals. Alloy Surfaces Co., 1115 N. 38th St., Philadelphia 4, Pa.

Circle No. **13** *on Reply Card*

Capsule Case History:



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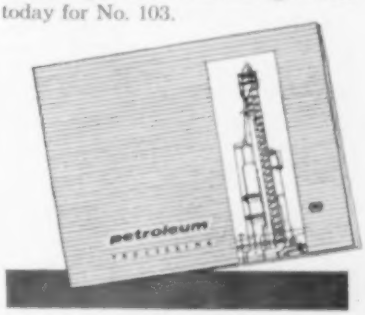

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NEW SAVINGS in your operations

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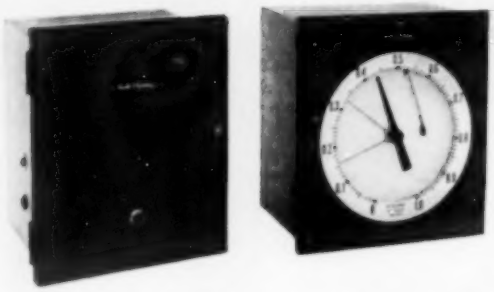
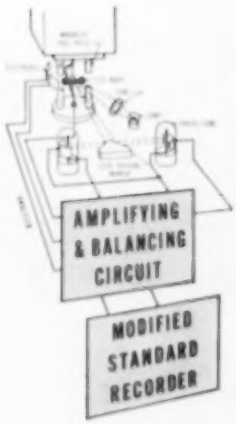
Arnold O. Beckman OXYGEN ANALYZERS



Pictured is the Model G2 Recording Analyzer—finest for precise oxygen measurement.

ON OPERATIONS LIKE THESE... MAKE SAVINGS LIKE THESE

PROCESSING AIR LIQUIFRACTION AND PRODUCTION OF HIGH PURITY GASES	*Better product quality with minimum oxygen or air contamination*
SAFETY PRODUCTION OF HYDROGEN, ACETYLENE, ETC.	*Control explosive atmospheres, reduce fire risks, minimize plant and personnel hazards*
PRODUCT PROTECTION RESIN KETTLES, COLOR PIGMENTS, PRODUCT STORAGE, ETC.	*Reduce oxidation, maintain product standards with controlled purge systems*



Unique Operating Principle

The various applications highlighted above are only a few of the many ways Arnold O. Beckman Oxygen Analyzers—industry's great new profit builders—are being used by progressive operators to boost profits, cut costs.

These are the *only* oxygen analyzers that *continuously* measure process streams by an advanced magnetic principle that provides *direct physical measurement of the oxygen itself*—not of some secondary relationship.

Heart of the unit, as illustrated, is a dumbbell-shaped test body suspended in a magnetic field. Sample gas surrounding this test body causes it to rotate in the field, depending upon the oxygen content of the gas. The movement of a light beam, reflected by a small mirror on the test body, is measured by simple electronic circuits... and the result indicated directly on a conventional recorder or indicator. It's simple, positive, accurate!

No chemicals—filaments—catalysts cams—complicated mechanical parts!

FEATURES OF THE G2

Many ranges: Full scale ranges 0-0.1%, 0-0.5%, 0-1% O_2 and others for low O_2 concentrations. Ranges 90-100%, 95-100% O_2, etc., for high O_2 concentrations.

Multi-Ranges: Any instrument may be supplied with two or more ranges.

Note: *For ranges wider than 0-5% O_2, ask about the Model E3 Analyzer.*

***Send for Helpful Free Literature** which describes this unique operating principle in detail—explains its many advantages and applications. When writing, outline your particular operations—we'll gladly supply specific information.*

Ask For Data File 15 J-65

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Instruments for Science and Industry

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SOUTH PASADENA, CALIFORNIA

What's New!

All Weather Plastic Tape

. . . **prevents corrosion** on pipelines and features increased adhesion and conformability at freezing temperatures. "Scotchrap" is a plastic tape claimed to be the first pressure-sensitive, polyvinyl chloride tape. In addition to low-temperature flexibility, the tape employs a built-in corrosion inhibitor. Use is recommended for wrapping above-ground and buried pipes in tank farms, chemical works, water mains, service lines, etc. Application is easy and especially suited for short jobs where it is not convenient to use cumbersome equipment or specially trained personnel. Two tapes are available—"Scotchrap" pipe insulation No. 50 is 10 mils thick for wrapping fittings or where maximum conformability is needed, and No. 51 is 20 mils thick for straight-run wrapping. Rolls come in 100-ft. lengths in widths of 1, 2, 6, 8, and 12 inches. Minnesota Mining and Manufacturing Co., 900 Fauquier St., St. Paul 6, Minn.

Circle No. **14** *on Reply Card*

Valve Testing Station

. . . **is semi-portable** and low priced. The "Universal Valve Test Stand" will test any size safety valve, including an 8 x 10. Claimed to cost less than cus-

ORBIT VALVES®

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LIQUIDS
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Orbit's principle of closure by compression is the most desirable and practical method of shut-off known. Closure by compression gives these advantages: Elimination of friction that in turn reduces wear which in return reduces frequency of repairs — a chain reaction that results in savings over the long haul to you.

See 22nd Edition of Refinery Catalog for full particulars on Orbit Forged Steel ASA Class valves or write for Catalog 55-B. A good range of sizes are available beginning with 1".

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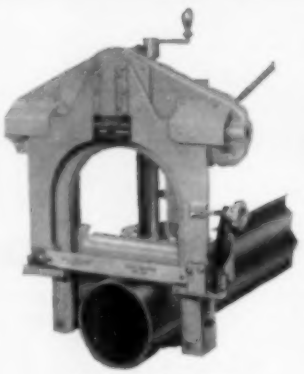

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WACHS GUILLOTINE SAW FACTS—

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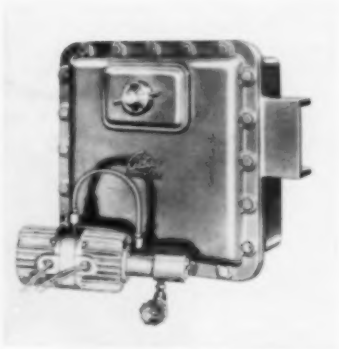
tom built-in-the-plant stations, the unit eliminates the need for valve repair work by outside shops—providing for rapid processing of maintenance valves as well as testing. Features include 4-in. H-beam skid mount for portability; accessory equipment such as spools, gages, gaskets, wrenches, lapping equipment, air tanks and compressors for pressure to 500 psig., an air-powered booster pump with 60 to 1 ratio for hydraulic pressure to 6000 psi., heavy forged C-clamps, and adapters for mounting valves. Floor space needed is 5 ft. x 3 ft. 8 in. Engineering is by ASME standards, with proper orifice sizes and test drum. Helium, nitrogen and other compressed gas testing is provided as optional equipment. Farris Engineering Corp., 533 Commercial Ave., Palisades Park, N. J.

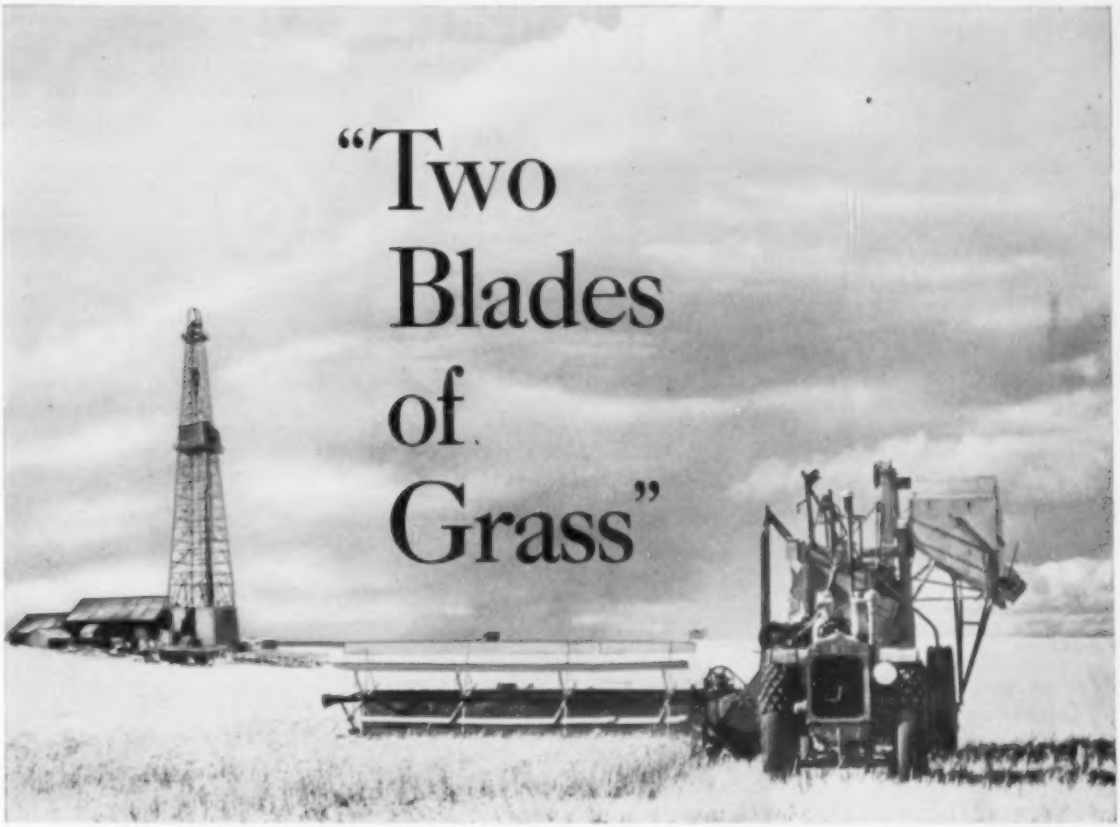
Circle No. **15** *on Reply Card*



Pipe Line Sampler

. . . operates automatically and is designed to extract accurate line samples of crude oil, fuel oil, gasoline and most other liquids. The "Gilbarco Sampler" can extract as many as 300 small samples per minute to give representative composite samples, and can be supplied with control proportional to either time or flow. Pressures to 350 psi. and temperatures to 200° F. can be handled by standard models, with up to 350° F. and higher pressures in special models. The sampler has no motor or mechanical switches, but is a small, low-capacity piston pump, magnetically operated from 20 to 300 cycles/minute. Stainless steel and other resistant materials are used, and the entire assembly is explosion-proof. The sampler can handle a wide range of viscosities, and is not affected by changes in liquid viscosity or gravity. Gilbert & Barker Mfg. Co., West Springfield, Mass.

Circle No. **16** *on Reply Card*



TWO CENTURIES ago Voltaire said, "He who makes two blades of grass grow in place of one renders a service to the State." The job of Standard Oil Company (New Jersey) and its affiliates is something like that – to produce oil where none was produced before and, by so doing, to create wealth for everybody.

How well have we been doing this job? Our Annual Report for 1954, which has just been sent to the 300,000 shareholders who own Jersey Standard, tells about it.

It tells how wealth was created by extending known oil fields . . . And by discovery of new ones . . . By converting crude oil, itself of little value, into hundreds of useful products . . . By moving petroleum products from where they were made to where they were needed.

All these things helped the people and strengthened the nations where we do business.

Some highlights of these activities, drawn from the Annual Report, are set forth here as a matter of public information.

1. During 1954, the free world used more oil than ever before. And oil is energy, which is basic to the world's progress.

2. To meet these needs, our affiliates produced and refined more oil than ever before in the Company's history. But additions to oil reserves were greater than the oil used.

3. We had vigorous competition everywhere. There is nothing like competition to bring you better products and service.

4. 1954 was our top year in sales, earnings, and dividends paid to owners.

5. During the year, we spent 764 million dollars for new equipment and for exploration. Since World War II, we have spent 5 billion dollars for the means to meet your future oil needs.

6. Research was productive. Our research affiliate obtained more patents on products and processes than any other oil company. In Linden, N. J., the first atomic laboratory in the oil industry is being built to study the uses of radiation in oil refining.

7. Current developments in atomic energy will mean greater availability of electric power: increased mechanization, expanded industry, and greater use of petroleum products. The oil business will gain, and you will have the benefits of both kinds of energy.

8. We played an important part in arranging to return Iran's oil to world markets.

9. A world's safety record for major refineries was set by Esso employees at Baton Rouge, La. . . . 7,911,769 man-hours with no disabling injury. This passed the previous record by more than a million man-hours.

10. We have long supported education through our taxes. We have also felt an obligation to aid privately supported colleges and universities, which are an important source of new employees and of informed citizens. During 1954, we contributed about a million dollars to such institutions.

If you wish a copy of the full Report for 1954, write to Standard Oil Company (New Jersey), Room 1626, 30 Rockefeller Plaza, New York 20, N.Y.

STANDARD OIL COMPANY (NEW JERSEY)
AND AFFILIATED COMPANIES

Esso

(To obtain more data on advertised products see page 916)

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The job offers the man we select an interesting opportunity in an exciting field of activity. He will have the chance to get better acquainted with the broader aspects of the petroleum processing industry, to meet and talk with its top-notch technical people, to be "in the know" about new developments in the industry even before they are announced. He will be affiliated with a dynamic, fast-moving publication, backed up by the largest and most progressive business magazine publishing firm in the world.

Here are the specifications:

Education: If you are the man we want, you're a graduate engineer, with a B.S. in mechanical engineering. You were in the top third of your class scholastically.

Industry Experience: You have had some practical experience (although maybe only a few years) in our industry. You are now employed by an engineering firm, or in the engineering department of a petroleum or chemical company, and associated in some technical capacity with petroleum refining, petrochemical manufacturing, or natural gasoline recovery. You know the kind of engineers who read Petroleum Processing, and the kind of problems they are up against.

Writing Experience: You have probably never thought of editorial work as a career, but you've been writing reports in connection with your work and found satisfaction in putting information down on paper in a clear, logical, organized manner. You may have done some writing as a hobby, or even have worked on a high school, college or similar paper or magazine. You can express yourself well.

Personality: You are curious about "why" and "how" things work, and you have the ability to explain their workings to others. You are able to organize your own work, and you have initiative to push ahead and get things done. You like meeting people and talking with them, yet at the same time you are a good listener. You are not a "glad-hander."

Location and Duties: You would welcome the chance to work in New York City, and you don't mind sitting behind a desk for a while, editing and rewriting other people's copy. Later (just as fast as you learn the ropes) you expect that you'll be given field assignments to gather data and write original articles.

Salary: You are now earning a respectable salary, and the chances are that this position will pay you even more right now—besides offering you the opportunity to rise more rapidly than you now expect to.

• If you think you are the man we want, send details on your background and experience (including salary history) to

William F. Bland, Editor
Petroleum Processing
330 West 42nd Street
New York, 36, N. Y.

• If we think you are a qualified candidate, we will make arrangements for a personal interview. All replies will be held in the strictest confidence.

Two Cracking Catalysts

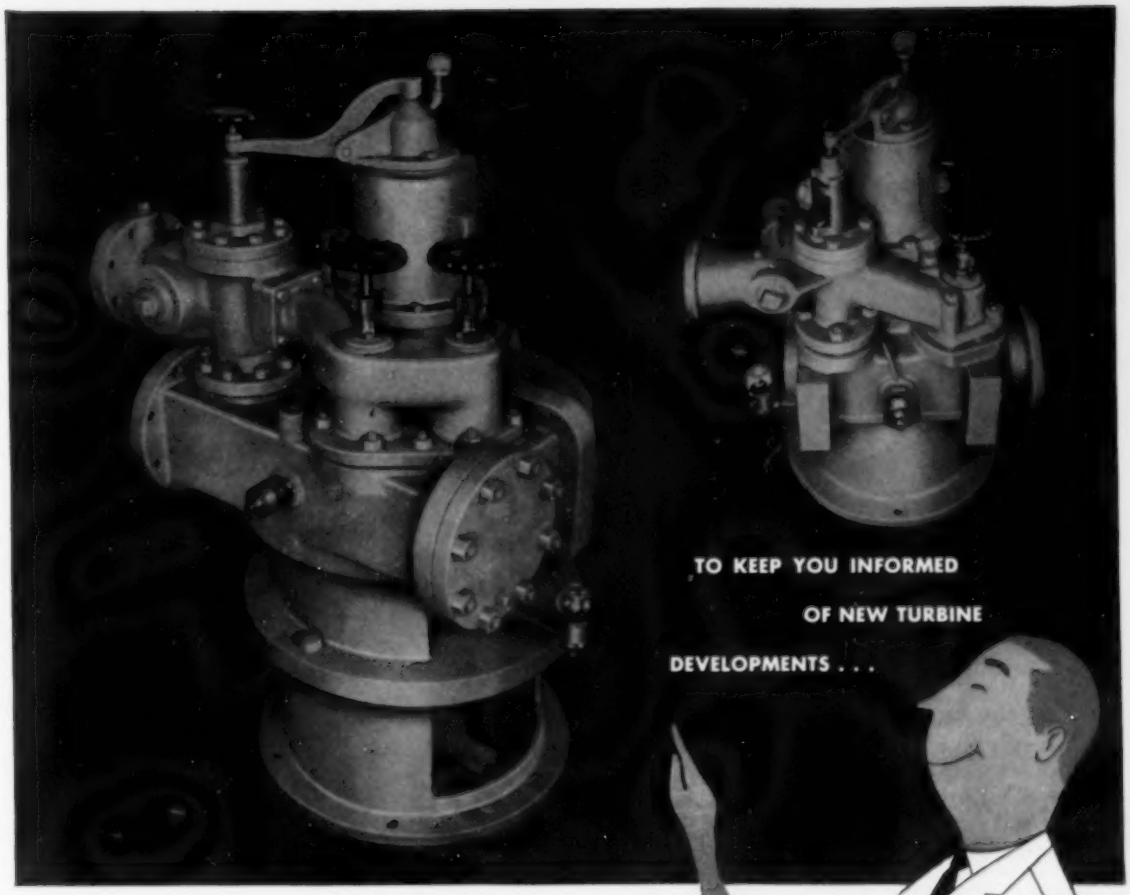
. . . have new properties for petroleum processes. A high alumina catalyst—with 25% alumina as against 13% in catalyst regularly supplied—features better maintenance of activity and surface area with low stack losses and high attrition resistance. The other catalyst—a low density product—has been developed to overcome previous tendencies for a lack of attrition resistance in low density catalysts. The low density product retains inherent advantages of higher stability of surface area, pore volume and catalytic activity under operating conditions without sacrificing the attrition resistance associated with higher density catalysts. Both catalysts have been extensively researched and field-tested. Davison Chemical Co. Div. of W. R. Grace & Co., Baltimore 3, Md.

Circle No. **17** *on Reply Card*

Safe Lighting System

. . . is for hazardous spots. The first complete lighting system for specific use at areas (Class I, Groups A and B) where acetylene and hydrogen are present. The system consists of the following UL-approved components: 150 and 200-watt EVA 295 pendant lighting fixtures, EAB junction boxes, FSPC tumbler switches, EYS seals, UNY unions, and EC series flexible couplings and flexible fixture hanger supports. No additional skills or tools are needed to install the new units as compared to the company's other explosion proof fixtures and fittings. Crouse-Hinds Co., Wolf and Seventh North Sts., Syracuse, New York.

Circle No. **18** *on Reply Card*



Here are a few of the many improved features which help make the new Dean Hill Vertical Turbines your best power-package buy:

1. **MORE POWER**—An added steam nozzle for Models DH-10V (new in vertical line) and DH-20V increased power *100%* over former one-nozzle counterparts. The DH-30V now has three steam nozzles and 50% more power.
2. **BETTER PERFORMANCE**—Two hand valves improve regulation of steam rate at reduced load. Improved packing boxes check steam pressure leakage and permit higher back pressures.
3. **LONGER SERVICE**—*Double-row* ball bearing has greater thrust capacity. Overlapping labyrinth slinger on lower bearing prevents moisture seepage.
4. **POSITIVE SAFETY**—Improved emergency trip mechanism has cylindrical guide to maintain alignment of trip valve stem in all positions.

MORE DETAILS?

You will want to study the other improvements in the DH Line . . . improvements made to increase the useful life and efficiency of the turbine without sacrificing the compactness and simplicity of design. Write now for our new Catalog No. 500, which includes full details on both Vertical and Horizontal DH Turbines.

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Sales Offices In: Chicago, New York, San Francisco, Boston, Cincinnati, Denver, Albuquerque, El Paso, Salt Lake City, New Orleans, Philadelphia, Tulsa, Los Angeles, Pittsburgh, Houston, Dallas, St. Paul, Toledo, Cleveland, Grand Rapids, Birmingham, Ala., Louisville, Memphis, Richmond, Mexico City, Montreal, Reading, Pa., The Hague, Washington, Charlotte, Casper, Wyo., Knoxville.

(To obtain more data on advertised products see page 916)

Leaders in refining, processing and manufacturing industries have selected Lincoln Explosion-Proof Floor Maintenance Machines. This proves Lincoln machines operate with absolute safety and effect substantial floor maintenance savings. A free demonstration will prove you can save up to 75% on your floor maintenance costs. Mail coupon today.

All electrical parts sealed for explosion-proof operation and carry Underwriter's Laboratories approval.

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- Douglas Aircraft Co.
- General Mills, Inc.
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( ) And arrange for a FREE DEMONSTRATION
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Platt's OILGRAM News Service, McGraw-Hill Publishing Co., 330 W. 42nd St., N. Y. 36, N. Y.

Free Trade Literature

In-Line Plant Design

. . . tailored to give a high ratio of output and flexibility per cost of land, construction and maintenance: *The Kelloggram, No. 1, 1955* discusses the principles and advantages of "in-line" plant design with plot plans, cross-section drawings and photographs for illustration. The M. W. Kellogg Co., 225 Bdwy., New York 7, N. Y.

Circle No. **19** *on Reply Card*

Nuclear Research Reactor

. . . planned as the first to be owned and operated by private industry: 13-page booklet *Neutrons for Industrial Research* describes the venture; planned facilities; proposed program; benefits; uses for petroleum, chemical, and other industrial projects; and describes the operation of the reactor. American Machine & Foundry Co., 261 Madison Ave., New York 16, N. Y.

Circle No. **20** *on Reply Card*

Barium Products

. . . used as oil and grease additives as well as in numerous other industrial fields: 24-page *Bulletin No. 135M* tells how barium products are made, gives physical properties of 9 commonly used barium compounds and discusses their care in handling. Westvaco Mineral Products Div., Food Machinery and Chemical Corp., 161 E. 42nd St., New York 17, N. Y.

Circle No. **21** *on Reply Card*

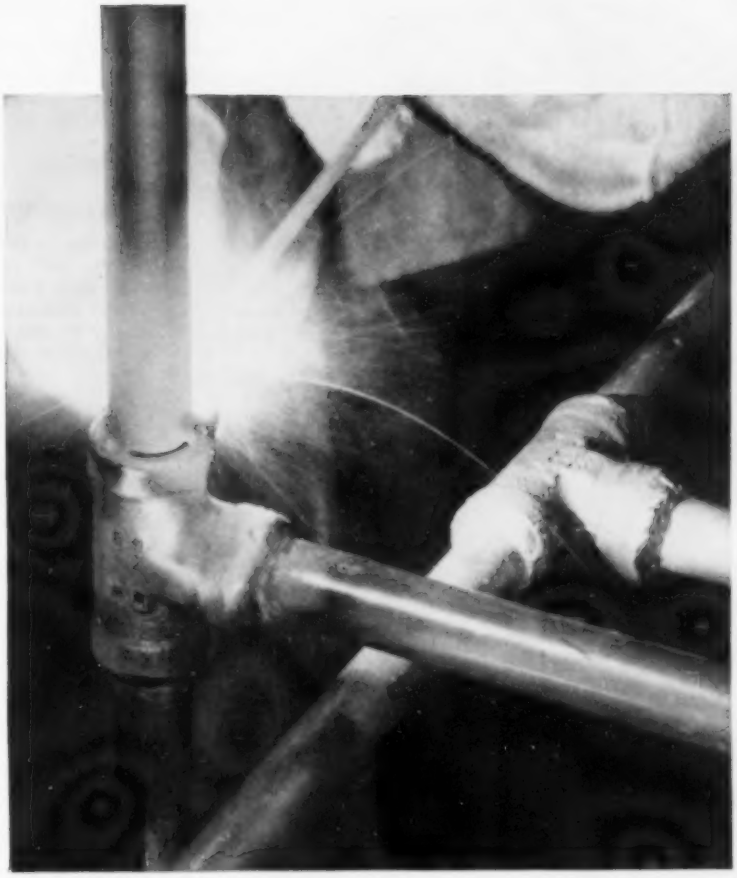
Fluid Cracking Catalyst

. . . contains 25% alumina for increased production of gasoline and other petroleum end products per pound of catalyst consumption: 19-page *Leaf-64-7-4500-3-55* contains paper presented at WPRA San Antonio, Texas, meeting in March describing development, properties, and testing of the high-alumina catalyst. American Cyanamid Co., Refinery Chemicals Dept., 30 Rockefeller Plaza, New York 20, N. Y.

Circle No. **22** *on Reply Card*

Aluminum Equipment

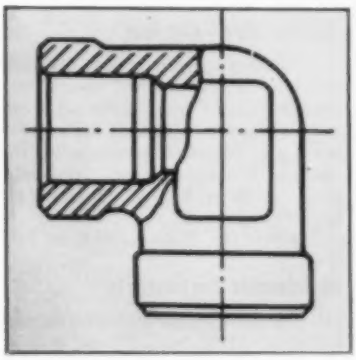
. . . designed for petroleum and petrochemical process applications: 80-page *Process Industries Applications of Alcoa Aluminum* gives current applications and advantages, available forms of aluminum alloys, corrosion resistance to over 450 common compounds and mixtures, design of process equipment, inhibitors, cathodic



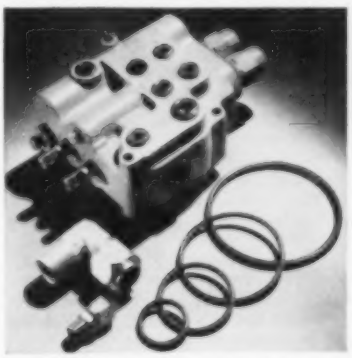
Announcing Parker Weld-lok tube fittings

machined from high-quality steel or stainless steel bar stock and forgings . . . for tubing ¼ through 2 inches O. D.

Simply insert tube; then weld! No wonder Parker's new *Weld-lok* tube fittings are so easy to use . . . for applications involving extreme temperatures, corrosion conditions, or wherever permanently welded joints are needed. With *Weld-lok* fittings, you get permanently tight lines . . . unaffected by vibration, shock, or thermal distortion. They're offered for tubing sizes ¼ through 2 inches O.D.—steel or stainless steel.



Tapered socket of *Weld-lok* fittings aligns and holds tube, while you weld. You don't need special fixtures or equipment to make correctly proportioned weld.



What other Parker products interest you? *Triple-lok* flare tube fittings or *In-tru* flareless tube fittings for instrumentation? Hydraulic control valves? O-rings?

TUBE AND HOSE FITTINGS DIVISION
Section 410-S
The Parker Appliance Co.
17325 Euclid Avenue
Cleveland 12, Ohio

Send New Parker *Weld-lok* Catalog No. 4370

Name _____ Title _____

Company _____

Address _____

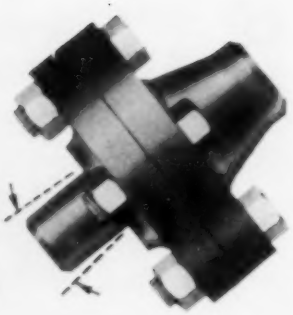
City _____ State _____

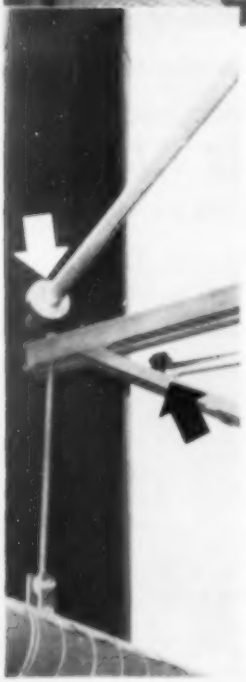
Mail this coupon for your copy of *Weld-lok* Catalog No. 4370. We will also send you the name of your nearest Parker distributor for *Weld-lok* tube fittings.

Parker

Hydraulic and fluid system components

HERE'S HOW
Refinery Engineers and Builders Use
BARCO FLEXIBLE STRUT JOINTS





—for Structural Applications

Barco Flexible Strut Joints are an important aid in *modern* refinery construction. A typical use is at the ends of struts for supporting or bracing large catalyst carrier lines or vent stacks on fluid catalytic crackers. In such cases, where horizontal lines require supports, two braces (with Barco Strut Joints in each) make costly "A" frames unnecessary. Other uses include guying tall vessels and columns and directing thermal movements of high temperature piping.

SIMPLE, VERSATILE!—The Barco Strut Joint is a dependable, compact, versatile fitting requiring practically no maintenance. It is a simple ball and socket that provides a point of flexibility. The close fit between ball and casing, allows for reversible loads, not possible with pin and clevis type braces. Barco Strut Joints support without restricting freedom of movement.

COMPLETE LINE—Available in following sizes and capacities: 1½"—8,000 lbs., 2"—12,000 lbs., 3"—20,000 lbs., 4"—50,000 lbs., 6"—130,000 lbs. Welding ends for field or shop use. Unique "Bar-Moly" treatment of wearing parts provides permanent dry lubrication for long service.

ENGINEERING SERVICE—Barco will be glad to work with your engineers in the selection of joints to meet your requirements. *Specifications and information on request.*

SEND for your copy of interesting new illustrated bulletin No. 28 showing OIL REFINERY AND PETROLEUM INDUSTRY applications for Barco Ball, Swing, and Strut Joints.

BARCO *Manufacturing Co.*

559G Hough Street • Barrington, Illinois

protection, metal coatings, and physical properties. Aluminum Co. of America, 1501 Alcoa Building, Pittsburgh 19, Pa.

Circle No. **23** *on Reply Card*

Solid-Liquid Proportioning

. . . dealing with what equipment and methods are available: two part reprint *Ref. No. B-I-F M1* from CONTROL ENGINEERING includes diagrams, tables, and typical installation drawings. B-I-F Industries, Inc., 345 Harris Ave., Providence, R. I.

Circle No. **24** *on Reply Card*

Pressure Readout Systems

. . . used to speed data handling for process and other industries: 12-page *Catalog 58-15* describes packaged multiple readout systems for up to 200 pressures simultaneously with a 1 part in 2000 accuracy, gives data on operation, applications, performance characteristics, dimensions, etc., Fischer & Porter Co., 393 Jacksonville Road, Hatboro, Pa.

Circle No. **25** *on Reply Card*

Lignin from Hardwood

. . . used in the asphalt, petroleum, oil well drilling, rubber and other industries: 14-page bulletin on *Meadol* discusses alkali lignin chemistry, properties, solubilities, viscosities, densities, oxygen absorption, uses and applications, and possible modifications. The Mead Corp., 118 W. 1st St., Dayton 2, Ohio.

Circle No. **26** *on Reply Card*

Scale Prevention

. . . forming in boilers, heat exchangers, etc., caused by hard waters: bulletin on *Cepi-Comav* discusses treatment of liquids to prevent and remove scale and corrosion products by the magnetic field-ionization principle. Cepi-American, Inc., P. O. Box 146, Columbus, Texas.

Circle No. **27** *on Reply Card*

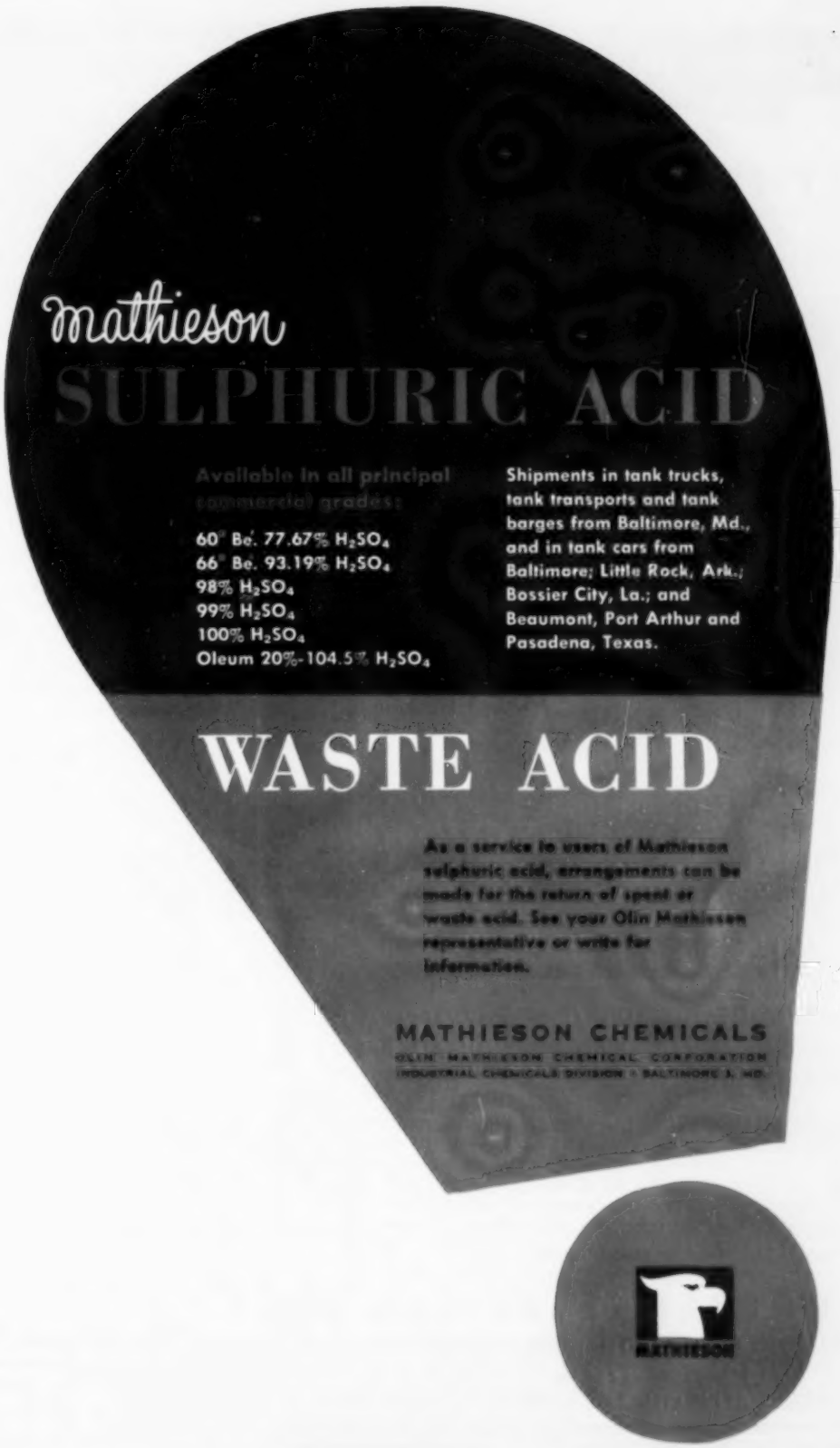
Economic Research

. . . giving an insight in marketing and industrial planning: 11-page booklet *Marketing and Economic Research . . . your problem?* discusses services available to aid in executive planning. Foster D. Snell, Inc., 29 W. 15th St., New York 11, N. Y.

Circle No. **28** *on Reply Card*

Laboratory Equipment

. . . used in scientific and research work: 20-page *Announcer No. 55-4-58* lists all types of analysis, measuring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Available in all principal commercial grades:
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ANNOUNCES

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For Analysis by Gas Chromatography

A simplified quantitative method of analysis is used—based on the differences in adsorption affinity of the components in a mixture.

Typical Applications Include:

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- Analysis for trace components.
- Routine, rapid control analysis for control component.
- Propane in commercial butane.
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- Analysis of organic acids, alcohols, ketones, aromatics, esters and other classifications of organic liquids.
- Particularly suitable for separating closely boiling compounds and determining specific components in complex mixtures.

EXTREMELY VERSATILE . . . .

THE KROMO-TOG AND ACCESSORY APPARATUS PROVIDES THE LABORATORY WITH ALL BASIC INSTRUMENTATION FOR GAS CHROMATOGRAPHY

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Manufacturers and Distributors of

SCIENTIFIC APPARATUS and LABORATORY CHEMICALS

and handling equipment, gives descriptions, models, and prices. Burrell Corp., 2223 Fifth Ave., Pittsburgh 19, Pa.

Circle No. **29** *on Reply Card*

Computing Services

. . . made available for firms throughout the country: 16-page brochure describes computational facilities and code library for the solution of problems in structural design, heat flow, distillation column and chemical reactions, etc. Computation Center, Midwest Research Institute, 425 Volker Blvd., Kansas City, Mo.

Circle No. **30** *on Reply Card*

Buty! Carbitol Data

. . . used as a solvent for many applications where low evaporation rates are required: information sheet *F-86.36* gives physical properties, specifications, shipping data, general solvent properties, constant-boiling mixtures, physiological properties and uses. Carbide and Carbon Chemicals Co., 30 E. 42nd St., New York 17, N. Y.

Circle No. **31** *on Reply Card*

Chloromethanes

. . . used as solvents and chemical intermediates: 28-page booklet gives uses, physical and chemical properties of methylene chloride, methyl chloride, chloroform and carbon tetrachloride, and discuss toxicity, azeotropic data, flammability, solubility, shipping, handling and storage. Solvay Process Div., Allied Chemical & Dye Corp., 61 Bdwy., New York 6, N. Y.

Circle No. **32** *on Reply Card*

Compressed Air Handbook

. . . written to aid in measuring effective air compressor capacity: *Bulletin No. 520-A* gives hook-up sketches and design tips designed to improve compressor installation capacities and includes a pipe size-air flow rate-gage pressure-pressure drop chart. Sarco Co., Inc., Empire State Bldg., New York 1, N. Y.

Circle No. **33** *on Reply Card*

New Ammonia-Urea Plant

. . . built for Grace Chemical Co. at Woodstock, Tenn., the second plant of its type in the United States: *Heat Engineering, March-April 1955* describes the manufacture of synthesis gas, ammonia, and urea with photographs, flow diagrams, materials, and utilities required. Foster Wheeler Corp., 165 Bdwy., New York 6, N. Y.

Circle No. **34** *on Reply Card*

(To obtain more data on advertised products see page 916)

A Book You Should Have on Mechanical Sealing...

A complete reference catalog on Dura Seal—the engineered mechanical seal that rotates with the shaft. Amply illustrated . . . specific applications . . . installation data. A fact book of real value to designers, operators and maintenance departments.

WRITE FOR DURA SEAL CATALOG NO. 455 PP

DURAMETALLIC CORPORATION

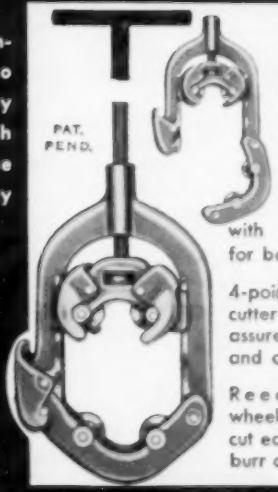
KALAMAZOO, MICHIGAN

IF YOU CUT LARGE DIAMETER PIPE... YOU NEED THESE

New **REED HINGED 4-WHEEL PIPE CUTTERS**

Four sizes cover the range from 2½" to 12"

Users tell us these completely new cutters are so efficient they often "pay for themselves" through the savings in crew time on a half-dozen cuts. They are the first really practical tools for cutting off steel or cast iron pipe in sizes from 2½" to 12". You can, for example, cut 8" steel pipe completely off in less than five minutes.



Four wheel design requires minimum swing of handle—less digging in ditch work, easier "tight-corner" cuts.

Closed frame permits light weight with complete rigidity for better cutting.

4-point guide aligns the cutter on the pipe . . . assures perfect tracking and a right angle cut.

Reed Razor Blade wheels track perfectly, cut easily and roll down burr on steel pipe.

Unconditionally guaranteed to be the most efficient cutter you have ever used. Ask your jobber or write for literature.

REED MANUFACTURING COMPANY

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now...

more effective and economical

ENTRAINMENT SEPARATION

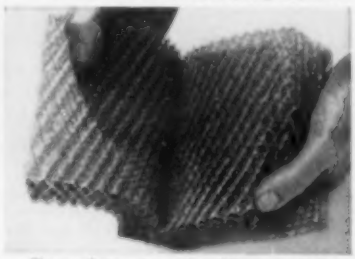
with the

NEW HI-THRUPUT HERRINGBONED MIST ELIMINATOR

Check these important points:

1. Half the pressure drop of Standard Mist Eliminator.
2. Safe operating limits – 10% to 12% higher velocity.
3. Entrainment removal practically 100% over wider operating range.
4. Three to four times longer on-stream life under coking conditions or where solids are present.
5. Lower cost – wires repositioned by Herringbone Fold*.

**U.S. Patent No. 2,565,846, Aug. 28, 1951*



These photos show the difference. Full explanation given in our Booklet ME-5.

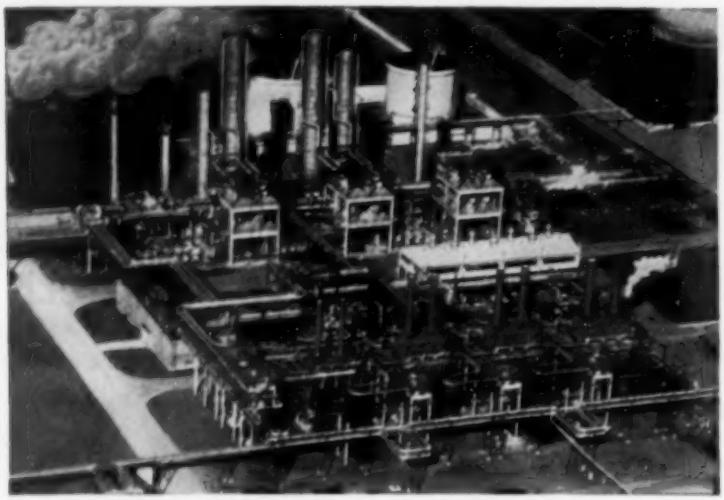
Send for Revealing Booklet ME-5. Learn how repositioning wires by patented Herringbone process and change in size and contour of mesh openings make this new Mist Eliminator more effective and economical.

METAL TEXTILE CORPORATION

Roselle, New Jersey

Metal Textile Corporation of Canada, Ltd., Hamilton, Ont.

(To obtain more data on advertised products see page 916)



Prefractionation and catalytic reforming section of Sun Oil Company's petrochemical plant at Marcus Hook, Pa.

BENZENE, TOLUENE, OR MIXED XYLENES ...Sun Contributes To Major Industries

Sun Oil Company can produce from a single plant, an annual rate of 19,000,000 gallons of benzene, 19,000,000 gallons of toluene, and 15,000,000 gallons of mixed xylenes . . . aromatic chemicals essential for industries such as rubber, textile, plastics, and for defense purposes.

The $15,000,000 petrochemical plant covers an area of 20 acres. Its maze of piping and vessels were designed for operational flexibility so that relative proportions of major products could be varied to meet any market demand. Substantial quantities of valuable by-products such as hydrogen, propane, butane, pentane, narrow boiling-range naphthas, and high-octane gasoline, can also be produced here.

The Kuljian Corporation was one of the firms co-operating with Sun's Engineering Staff in the design and engineering of the prefractionation and catalytic reforming sections as shown above.

Next time your plans call for a complete new plant, alterations, or expansion, find out how Kuljian services can be of help. Whether your problem is one of design, engineering or construction, our vast facilities and technical know-how can be made available to you anytime . . . anywhere. Your inquiry would be most welcome.

A booklet "New Aromatics Plant" tells you the complete story. Why not write for your copy today.

The Kuljian Corporation

engineers • constructors

1200 North Broad Street • Philadelphia 21, Penna.

BRANCH OFFICES THROUGHOUT THE WORLD

What's New!

Liquid Level Gages

. . . made for recording, indicating, controlling and telemetering applications: 26-page *Bulletin L-701* describes gages and auxiliary equipment, gives typical installation illustrations, equipment specifications and dimensions. The Bristol Co., Waterbury 20, Conn.

Circle No. **35** *on Reply Card*

Harnessed Tubes

. . . made for instrumentation installations: 10-page *Data Book* describes the webbed plastic harnassing of instrument tubing, specifications, unpacking, installing, junction boxes, physical properties and chemical-resistant characteristics for over 50 chemicals. Dekoron Products Div., Samuel Moore and Co., Mantua, Ohio.

Circle No. **36** *on Reply Card*

Nickel Alloys

. . . made for corrosion resistant applications: 13-page reprint on low-alloy steels and 12-page reprint on cupro-nickel steels discuss performance under different service conditions giving tables, graphs, and figures. The International Nickel Co., Inc., 67 Wall St., New York 5, N. Y.

Circle No. **37** *on Reply Card*

Absorption Refrigeration

. . . producing large-capacity cooling from steam with no moving parts and using plain water as a refrigerant: 36-page *Catalog A.I.A. No. 30-F-22* describes operation of the refrigeration cycle, lists capacities and characteristics for 22 models, and gives engineering data. Carrier Corp., Syracuse, N. Y.

Circle No. **38** *on Reply Card*

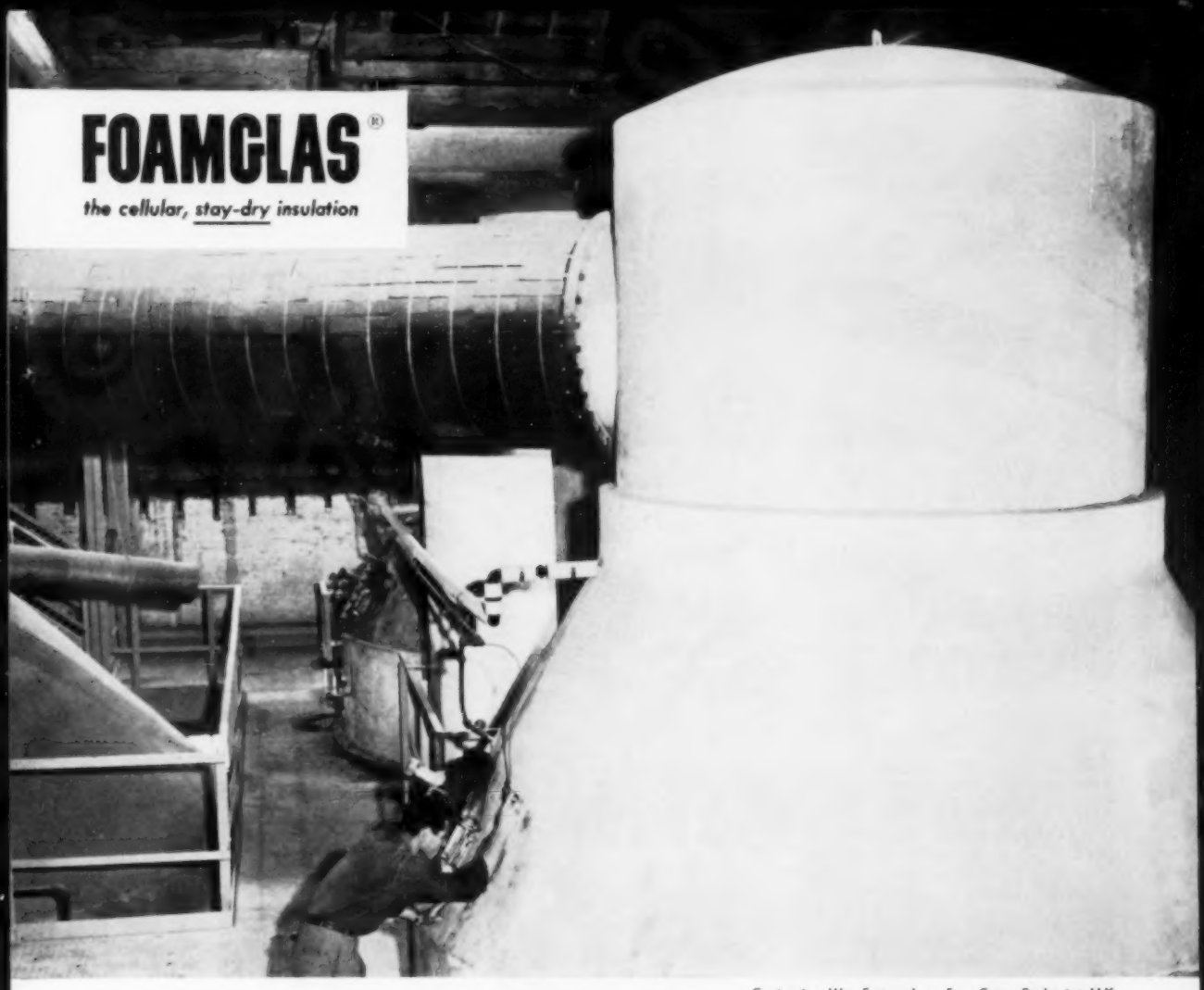
Exchanger Welding

. . . stressing new techniques made necessary by increasing service requirements: *Alco Products Review, Spring 1955* discusses tube-to-tube-sheet welding for different exchanger types and requirements, and gives a picture description of Frontier Oil Co.'s modernized Buffalo, N. Y., refinery. American Locomotive Co., Box 1065, Schenectady 1, N. Y.

Circle No. **39** *on Reply Card*

Gamma Radiography

. . . used in inspection procedures: 12-page booklet presents basic information for setting up or operating a gamma-radiography installation, selection of proper equipment, and safety, and gives charts showing characteris-



Contractor: Wm. Summerhays Sons Corp., Rochester, N.Y.

FOAMGLAS insulation stays dry, effective and re-usable for International Salt

reports R. B. Richards, Chief Engineer, New York Evaporating Plants, International Salt Co., Inc.

"Our evaporation process requires an insulation that's high in both efficiency and strength," says Chief Engineer R. B. Richards, International Salt Company, Inc., Watkins Glen, N.Y. "That's why we picked FOAMGLAS to insulate our evaporating pans and piping."

Mr. Richards explains, "Moisture-proof FOAMGLAS stays dry and effectively prevents excessive heat loss which would upset the exact temperature-pressure balance our process requires.

"Also we're in the middle of a 4-year construction job, redesigning and renewing our entire evaporation system. Maintaining full production now calls for constant shifting of pipes and lines. The pre-cut shapes of FOAMGLAS are so strong and rigid that we are able to remove them, move the line and re-use the same pieces of insulation."

Pittsburgh Corning Corporation

One Gateway Center • Pittsburgh 22, Pa.
In Canada: 57 Bloor St. W., Toronto, Ontario

Like International Salt Co., producers of Sterling Salt, you too will benefit from the unique properties of this cellular glass insulation. Send the coupon right away.

Pittsburgh Corning Corporation, Dept. PP-65
One Gateway Center, Pittsburgh 22, Pa.

Please send me FOAMGLAS literature on the following:

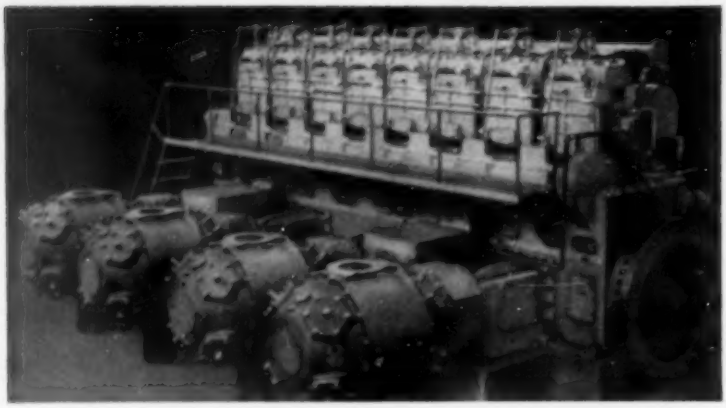
- ☐ Building insulation
- ☐ Insulation for cold storage space
- ☐ Pipe insulation
- ☐ Insulation for tanks and other equipment
- ☐ Send free sample of FOAMGLAS
- ☐ Send engineer to discuss a specific insulating problem

NAME

COMPANY TITLE

ADDRESS

CITY ZONE STATE



How one refinery eliminated scale build-up in compressors

Oakite Airefiner No. 52 prevents scale formation— cuts downtime, maintenance

Every 6 to 8 weeks a Southwestern refinery had to run acid through compressor water jackets to remove thick lime scale deposits. That meant compressors down for half a day. What could Oakite do?

The Oakite Man first descaled the jackets with Oakite Compound No. 32. Then he charged the spray pond with Oakite Airefiner No. 52, and set up a schedule for maintaining proper pH in the solution.

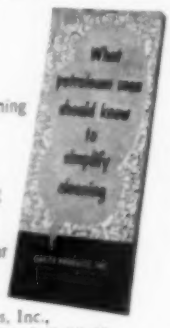
Results: Manifold temperatures reduced — no more descaling, no more cracked blocks or heads, no more compressor downtime.

Proving that — in industrial cleaning it always pays to consult Oakite.

Call your Oakite Technical Service Representative. His experience is yours to draw on. He'll study your cleaning problem, suggest and demonstrate the best material and method. He'll keep checking back to see that you get top quality cleaning at low cost. Call him today!

FREE HANDBOOK— full of facts on

- Drum reconditioning
- Descaling
- Cleaning tanks
- Salvage cleaning
- Paint stripping
- Cleaning tank car interiors



Write Oakite Products, Inc., 50D Rector St., New York 6, N. Y.

SPECIALIZED INDUSTRIAL CLEANING
OAKITE petroleum service division
Technical Service · MATERIALS · METHODS · SERVICE · Representatives in Principal Cities of U. S. and Canada

"Vaporization Equalibrium Constants And Activity Coefficient Charts"

You can still get a copy of this popular reprint—41 working scale charts (21 equilibrium constant charts for the hydrocarbons from methane to 700°F. boiling point, and 20 activity coefficient charts), plus a description of how to use them. 48 pages, 8½ x 11, paper bound (1949) $1.50

Address Reader's Service Department
PETROLEUM PROCESSING
330 West 42nd Street
New York 36, N. Y.

Note: New York City residents add 3% Sales Tax.

tics, radiographic sensitivity, and speed of isotopes. Technical Operations, Inc., 6 Schouler Court, Arlington, Mass.

Circle No. **40** *on Reply Card*

Chemicals Catalog

. . . includes detergents, wetting agents, emulsifiers, brighteners, sequestrants, and dyeing assistants: 40-page catalog gives chemical sources, standard packing, description, and some physical and chemical properties. Antara Chemicals, 435 Hudson St., New York 14, N. Y.

Circle No. **41** *on Reply Card*

Formalin Manual

. . . designed for training formaldehyde handlers: 27-page *Formalin Handling Manual* discusses formaldehyde specifications, receiving and unloading, temperature control, storage, safety and personnel protection, methods of analysis, and gives a temperature-density table. Celanese Corp. of America, 180 Madison Ave., New York 16, N. Y.

Circle No. **42** *on Reply Card*

Wrought Iron Pipe

. . . used for long, dependable service at a low cost per year: 48-page *Wrought Iron Pipe Catalog* contains technical information for engineers, piping contractors and others; includes dimensional pipe data, recommended installation procedures, bundling schedules, and a friction-flow-heat nomograph. A. M. Byers Co., 411 Seventh Ave., Pittsburgh 19, Pa.

Circle No. **43** *on Reply Card*

Nucleonics Catalog

. . . listing materials and equipment for research, laboratory, and process applications: 111-page *Catalog D* lists scalers and accessories; sample holders and changers; survey meters; Geiger-Mueller, scintillation, custom, industrial and medical equipment; tagged radioactive chemicals and services. Tracerlab, Inc., 130 High St., Boston 10, Mass.

Circle No. **44** *on Reply Card*

Petroleum Resins

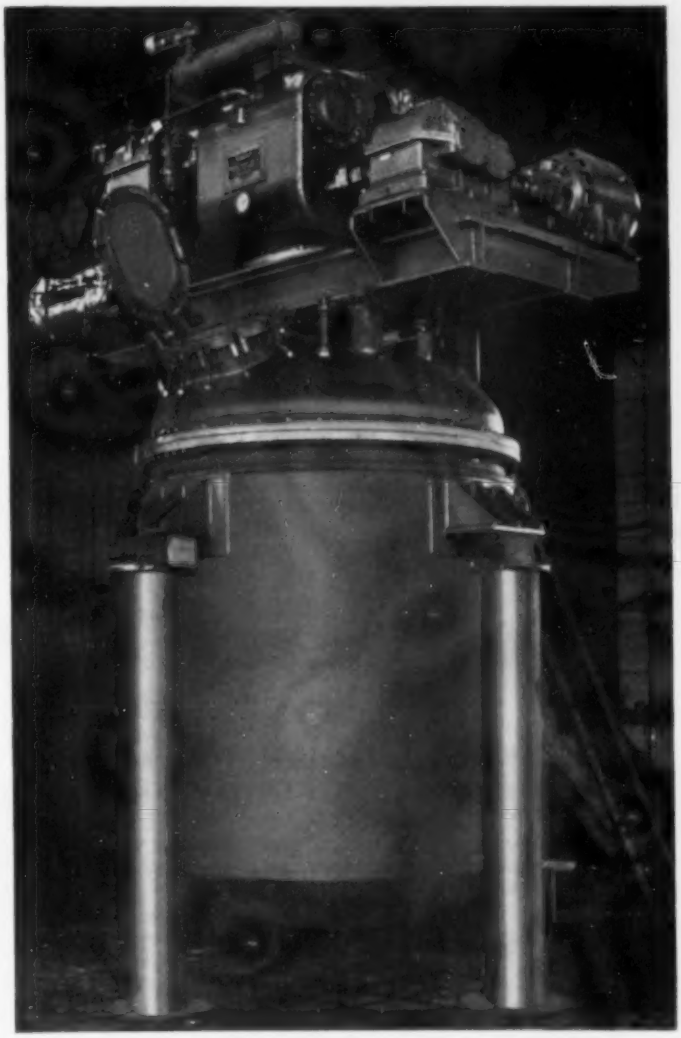
. . . made to give high physical quality at low costs where dark colors are not objectionable: brochure *Kermac Resin 641* gives general physical properties, weatherability, inertness, compatability and advantages. Kerr-McGee Oil Industries, Inc., Kerr-McGee Building, Oklahoma City 2, Okla.

Circle No. **45** *on Reply Card*

Buflovak Jacketed Grease Kettles are engineered for specific process requirements

...to fit specific processing operation needs

...to provide profitable performance



The kettle illustrated is a Buflovak Jacketed Grease Kettle with a 2500-gal. capacity. It is equipped with a compact 150-hp Cone Gear Drive for operating a Double Motion Agitator, with scrapers, to speed operation. A pneumatic discharge valve saves valuable time. It was designed and engineered by Blaw-Knox engineers to meet the specific requirements of the operation for which it was built.

We can help you solve your kettle problems. Blaw-Knox engineers have had a broad experience in designing and building kettles of every description, from the laboratory—few-gallon, capacity models to ones that process several thousand gallons—not just greases but a large number of varied products. This experience enables our engineers to incorporate in the design of each kettle all the features that are particularly applicable to the operation under consideration. Such features include size of kettle, type of body, agitators, drive, high or low temperature control, method of heating and cooling, heat source, openings and outlets, and so on.

Why not call us and let Blaw-Knox engineers make their recommendations?

A Complete Process Equipment Service

Kettles of every description constitute but one phase of Blaw-Knox Process Equipment design, engineering and fabrication service for the chemical, food, pharmaceutical, plastic and resin, petroleum, rubber and other industries: EVAPORATION • DRYING • FLAKING • MIXING • REACTION IMPREGNATING • VULCANIZING • SOLVENT RECOVERY SOLVENT EXTRACTION • CRYSTALLIZATION • DISTILLATION POLYMERIZATION • GAS CLEANING • GAS ABSORPTION • HEAT TRANSFER • VAPORIZATION • CONDENSATION • STERILIZING LOW AND HIGH PRESSURE PROCESSING

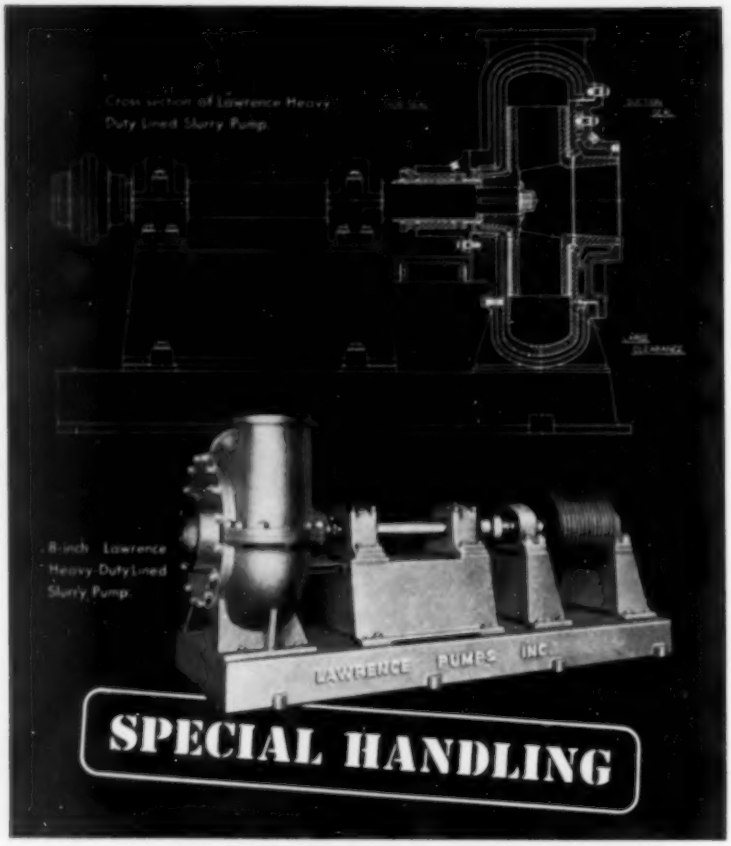
CATALOG NO. 356-R is available on request

BLAW-KNOX

Everything in Process Equipment

BLAW-KNOX COMPANY
BUFLOVAK EQUIPMENT DIVISION
1641 Fillmore Avenue, Buffalo 11, N. Y.

(To obtain more data on advertised products see page 916)


Cross section of Lawrence Heavy Duty Lined Slurry Pump
8-inch Lawrence Heavy-Duty Lined Slurry Pump
LAWRENCE PUMPS INC.
SPECIAL HANDLING

for heavy abrasive slurries with solids in suspension

Where abrasive wear is unusually severe or could cause severe damage if the casing wore out, a Lawrence Lined Slurry Pump provides the answer.

The pump is built with a casing liner, disc liner and impeller made of hard, brittle, abrasion-resistant alloy such as manganese steel, Ni-hard, etc. As the casing is designed to withstand full pressure, the liner can be used until actually worn out. Renewal of both the liner and the impeller (if necessary) is very simple because the casing is split horizontally.

The impeller is made with extra large clearances to prevent clogging. Sealing connections are provided on the suction disc and on the hub to flush out any grit or solid matter to prevent wear at these points.

For complete information about Lawrence Slurry and Sludge Pumps write for Bulletin 207-4.

LAWRENCE PUMPS INC.
361 Market Street, Lawrence, Mass.

What's New!

Viscometers

. . . applied for product quality control and measurement: 11-page booklet contains more than 20 illustrations to explain basic concept of viscosity and the various types of flow showing the effects of variables upon final consistency. Drage Products, 406 Thirty-second St., Union City, N. J.

Circle No. **46** *on Reply Card*

Electron Microscope

. . . used in science and industry: brochure *3R2546* discusses its principles, operation, specifications, and gives photographs showing applications in metallurgy, chemical processing, production control, etc. Scientific Instruments, Building 15-1, Engrg. Products Div., Radio Corp. of America, Camden, N. J.

Circle No. **47** *on Reply Card*

Gas Analyzers

. . . used in pilot plant operations for producing hydrogen from natural gas using infrared equipment: *The L-B Analyzer, First Quarter, 1955* describes the use and installation of these analyzers. Liston-Becker Instrument Co., Inc., 649 Hope St., Springdale, Conn.

Circle No. **48** *on Reply Card*

Rare & Fine Chemicals

. . . made available for purchase: 12-page price list for 1955 for approximately 600 different compounds. K & K Laboratories, 29-46 Northern Blvd., Long Island City 1, N. Y.

Circle No. **49** *on Reply Card*

Insulation Manual

. . . revised and brought up to date for users: 80-page *85% Magnesia Insulation Manual, 2nd Ed.* gives information on chemical and physical properties, conductivity, density, fire-resistance, water-resistance, application techniques, etc. Copy available by writing to The Magnesia Insulation Manufacturers Assoc., 1317 F St., N. W., Washington 4, D. C., stating company and title.

Do Not Use Reply Card

Corrosion Manual

. . . gives methods of equipment and structure protection by use of special cements, bricks and plastic coatings: 23-page *Corrosion Engineers Manual* discusses different materials for special applications; gives construction basics, physical properties and corrosion resistance of protective materials; and

BETZ • *A Great Name*
In Water Conditioning

Consulting is a full time job, too!

In our continuing efforts to engineer sound water conditioning for industry, our service activities extend into many phases of this exacting field.

The Betz Consulting Division, for example, is typical of the completeness and diversification of the service we offer.

This separate unit of the organization, staffed with qualified chemical, mechanical and sanitary engineers, provides full-scale engineering services on a variety of problems relating to the *external* conditioning of industrial water for process, cooling, and boiler feed requirements, and the treatment of industrial waste and sewage.

Whether the water or waste problem is of broad or limited scope, the Betz Consulting Division matches *service* to *need* through its many activities such as

. . . economic and technical surveys . . . chemical engineering research . . . pilot plant design and operation . . . equipment specification and procurement . . . process design and supervision . . . start up operation . . . continuous supervisory service.

This specialized consulting service is *another* reason why Betz continues its leadership in providing completely-integrated engineering on all water problems.

Ask a Betz District Engineer the next time he calls how Betz Consulting Service can help you solve *your* water problem. He'll be happy to provide the details.

W. H. & L. D. BETZ, Gillingham & Worth Streets, Philadelphia 24, Pa. In Canada: BETZ Laboratories Limited, Montreal 1.

BETZ

CONSULTANTS ON INDUSTRIAL WATER PROBLEMS

(To obtain more data on advertised products see page 916)

"Alamask"

offers a complete and diversified line of reodorants for petroleum and allied products

No longer need the products of the petroleum industry inflict upon their users the obnoxious odors resulting from the mercaptans and sulfides in their processing.

Years of development work and product-testing have culminated in a complete line of Alamask® reodorants that can successfully mask the objectionable odors of many petroleum products. Check this table to see which Alamask reodorants will solve your malodor problems:

"ALAMASK"	GASOLINE FRACTIONS	ASPHALTIC COMPOUNDS	KEROSENE BLENDS	COAL SPRAY OILS	SPACE HEATERS	CUTTING OILS	CLUTCH OILS	DIESEL FUELS	JET FUELS	MINERAL SPIRITS	WAXES	NAPHTHA	BURNER OILS
AAM								X					
AO						X	X						
AR		X								X			
BGM		X											
BN						X	X						X
BUL				X	X			X			X		X
CC			X							X			
CE			X							X			
CX											X		
MS			X							X	X	X	X
0.19	X				X	X	X		X				X
0.20	X				X	X	X		X				X
TO									X				

Rhodia's chemists and engineers, experienced in odor abatement and waste disposal, will provide technical assistance to you in your efforts to correct malodors.

For complete information on these new, highly-effective reodorants, write today to Rhodia, Inc., Industrial Reodorants ("Alamask") Division, 230 Park Avenue, New York 17, N. Y.

Rhodia INC.

Do You Have A Copy Of . . .

"REFINERY INSTRUMENTS—WHAT MAKES THEM TICK?"

A series of 8 articles by Cornelius E. Shannahan, instrument engineer with M. W. Kellogg Co., dealing with the four basic refinery instruments (pressure, temperature, flow, level), plus sections on controllers, control valves and pneumatic transmission.

40 pages, 9¼x11⅛, paper bound (1951-2) $1.00

Address Reader's Service Department
PETROLEUM PROCESSING
330 West 42nd St, New York 36, N. Y.

Note: New York City residents add 3% Sales Tax

tips and facts on tank and floor construction. Nukem Products Corp., 111 Colgate Ave., Buffalo 20, N. Y.

Circle No. **50** *on Reply Card*

Automatic Control

. . . applied as a solution of industrial process problems: 16-page *Educational Bulletin No. 9* discusses millivoltmeter applications to a control instrument, oscillator circuits in pyrometer controllers, and gives information to help determine the proper type of control system. Barber-Colman Co., Wheelco Instruments Div., Rockford, Ill.

Circle No. **51** *on Reply Card*

Safety Equipment

. . . for eye protection, head protection, respiratory protection, and welding: 64-page *Catalog No. 54* lists all equipment with dimensions, styles, applications, and specifications. Willson Products, Inc., Reading, Pa.

Circle No. **52** *on Reply Card*

Industrial Instruments

. . . and equipment with the latest developments: 24-page *Catalog 5002* covers pyrometers, potentiometers, null indicators, and the measurement of temperature, pressure, liquid flow, liquid level, with information on pneumatic remote transmission, systems and components, panelboards, valves, transmitters, switches, starters, contactors, relays, etc. Minneapolis-Honeywell Regulator Co., Industrial Div., Wayne and Windrim Aves., Philadelphia 44, Pa.

Circle No. **53** *on Reply Card*

Rust, Corrosion Inhibitor

. . . for petroleum products: 20-page booklet *Santolene C* describes the ashless organic liquid used in concentrations of from 10 to 40 ppm in clean petroleum products found in tankers, pipelines, storage tanks, etc., discussing its compatibility with antioxidants, scavengers, dyes and other additives used in gasolines. Monsanto Chemical Company, St. Louis 4, Mo.

Circle No. **54** *on Reply Card*

Pump Trouble Chart

. . . designed to quickly identify the probable source of failure or erratic performance in the most widely used types of rotary displacement pumps: *Pump Chart Spots the Trouble* details over 25 possible mechanical and chemical trouble symptoms such as noisy and intermittent operation, rapid

(To obtain more data on advertised products see page 916)

CB&I Structures for Refineries everywhere!

20-ft. diam. by 64-ft. 6-in. vacuum column built for the Esso Standard Oil Company at Baton Rouge, Louisiana.

CB&I

Chicago Bridge & Iron Company

Atlanta • Birmingham • Boston • Chicago • Cleveland • Detroit • Houston
Los Angeles • New York • Philadelphia • Pittsburgh • Salt Lake City
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Plants in BIRMINGHAM, CHICAGO, SALT LAKE CITY and GREENVILLE, PA.
REPRESENTATIVES AND LICENSEES:
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In refineries throughout the world, CB&I structures, designed, fabricated and erected for operation under a wide range of vacuum, pressure and temperature conditions, are providing the efficient, high capacity equipment that is necessary to obtain the highest yield from every barrel of crude oil.

Write our nearest office for information, estimates or quotations on CB&I built structures.

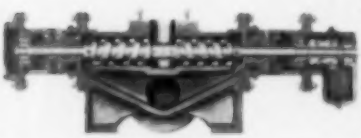
Esso BAYWAY (N.J.) REFINERY

pumps wide range of Fuel Oils with

Sier-Bath SCREW PUMP

The Sier-Bath Screw Pump above is handling fuel oils in viscosities from 60 SSU to 15,000 SSU discharging against 200 psi., under operating temperatures of 100° to 200° F. Pump is an external gear and bracket type, having steam jacketed body.

Sier-Bath SCREW PUMPS



External Gear and Bearing Bracket Type for non-lubricating liquids and semi-liquids

Internal Gear and Bearing Type for lubricating liquids and semi-liquids

Sier-Bath Screw Pumps maintain high volumetric efficiency because "Dual-Controlled" precision rotor design prevents rotor-to-rotor or rotor-to-casing contact—provides a continuous flow without pulsation, hammering or vibration . . . without strains, misalignment and wear on rotors, shafts, bearings and gears.

Result: Dependable, uninterrupted pumping service—less downtime—less maintenance—easier servicing—longer pump life—lower overall pumping costs.

Capacities from 1 to 1,000 gpm.; viscosities from 32 SSU to 1,000,000 SSU; discharge to 1,000 psi. for viscous liquids, 200 psi. for water and light oils. Horizontal or vertical construction. Corrosion resistant alloys, special bodies, stuffing boxes and bearings for special needs. Call your Sier-Bath representative or write Sier-Bath Gear & Pump Co., Inc., 9261 Hudson Blvd., North Bergen, N. J.

Sier-Bath ROTARY PUMPS

Screw Pumps Gerotor® Pumps Hydrotor® Pumps

50th Anniversary Mfrs. of Precision Gears, Rotary Pumps, Flexible Gear Couplings Member A.G.M.A.

wear, leakage, seizure, foaming, etc. Eco Engineering Co., 12 New York Ave., Newark 1, N.J.

Circle No. **55** *on Reply Card*

Motor-pump Selection

. . . from ¼ to 75 hp for capacities of 5 to 2800 gal./min.: 23-page bulletin, *Form 7093-E*, is to aid in selecting the correct size and model, giving advantages and design features with detailed illustrations and tables of dimensions, weights, performances and mountings, including a typical pumping problem with its solution, plus pipe friction tables. Ingersoll-Rand, 11 Broadway, New York 4, N.Y.

Circle No. **56** *on Reply Card*

Pneumatic Controller

. . . for control of process variables such as temperature, pressure, liquid level and humidity and featuring a more easily read scale and simplified maintenance: 11-page *Bulletin 5A-13* describes the "Model 41A" for on-off or proportionate control with diagrams, explanations and typical applications. The Foxboro Co., Foxboro, Mass.

Circle No. **57** *on Reply Card*

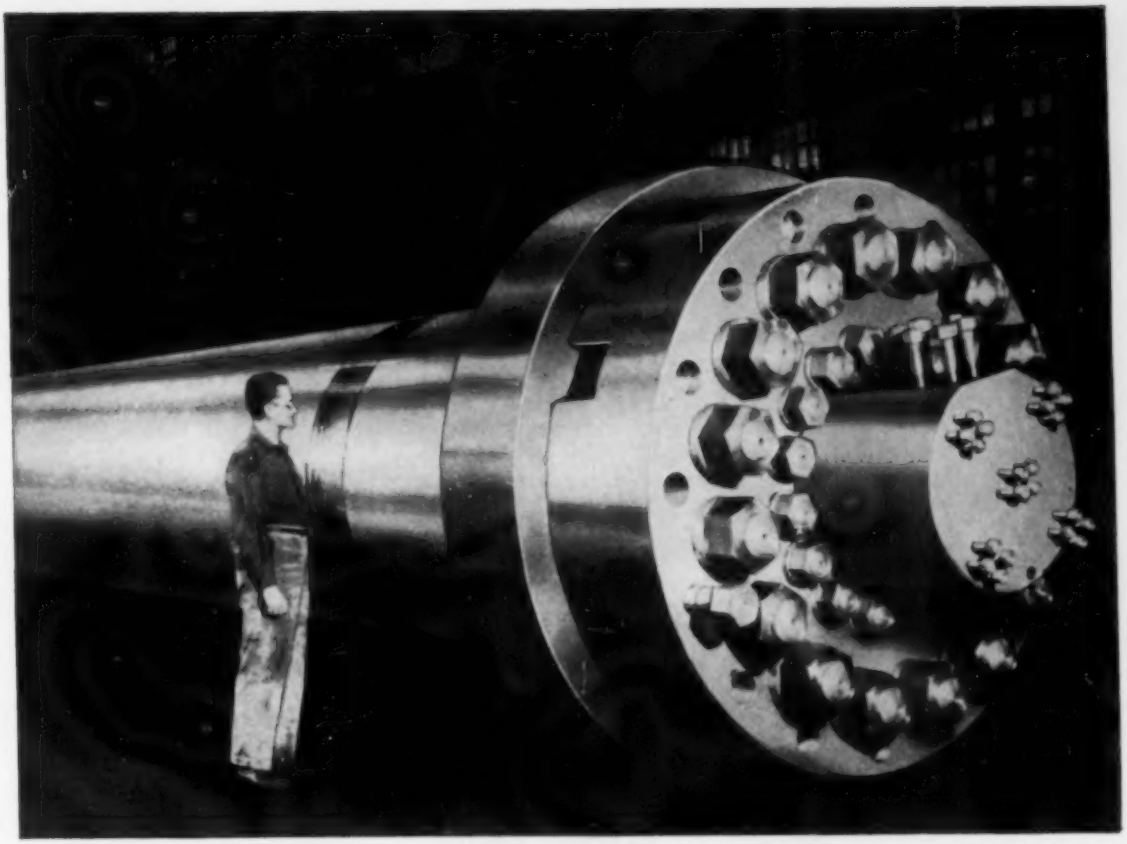
Did You Miss These?

The following items, reviewed originally in March, have aroused considerable interest among the readers. They are repeated briefly as a service to those who might have missed them the first time they appeared. For details or literature, please use the regular Reply Card in this issue.

New Control Valve

. . . **handles solids in suspension**, acid slurries, or other bulky materials. The "Red Jacket Valve" can be operated either pneumatically or hydraulically for on-off service or as a control valve. Construction is of a cast iron body inside of which is a sleeve of pure gum rubber, butyl, or neoprene. Air or hydraulic pressure in the annular space between the sleeve and body compress the sleeve, constricting the flow of material through the sleeve. The impulse from the controlling instrument or solenoid valve can be put directly into the valve body. Cast iron bodies are satisfactory for operation up to 150 psig., and steel bodies are available for pressures of 600 psig. and higher. The pure gum rubber sleeves are reinforced with multi-ply cords and will withstand temperatures of 180° F. Differ-

(To obtain more data on advertised products see page 916)



PRESSURE STARTS *Right* AT THE BEGINNING!

Product—Converter
Working Pressure—4,500 P. S. I.
Inside Diameter—45"
Tensile Strength—75,000 P. S. I.
Material—Chrome-Vanadium Steel
Closure—Bridgman
Installation—Union Carbide and Carbon Corp. Texas City, Texas

Midvale pressure vessels are right from the start. Designed right in cooperation with customer's engineers. Made right from the pouring of the steel to final machining. Proved right by extensive sonic, hydrostatic, strain-gage and X-ray tests.

This big brute is an example of Midvale's vast experience and facilities and is the result of complete cooperation in design and building with the engineers of Union Carbide and Carbon Corporation.

This pressure vessel started as a 550,000 pound ingot of chrome-vanadium steel, poured by Midvale's steel making specialists. Then carefully hollow forged to rough shape on 14,000 ton and 7,500 ton presses . . . hydrostatically tested at 9,000 P. S. I. for a working pressure of 4,500 P. S. I. It has been successfully operating for years at Texas City, Texas.

Forged steel converters, reactors, separators, autoclaves . . . any size or type . . . Midvale has the complete facilities and the experienced craftsmen to make them to withstand high pressures, high temperatures and resist corrosion. Next time your plans include pressure vessels get in touch with Midvale. Let our engineers work with you from initial design to final installation.

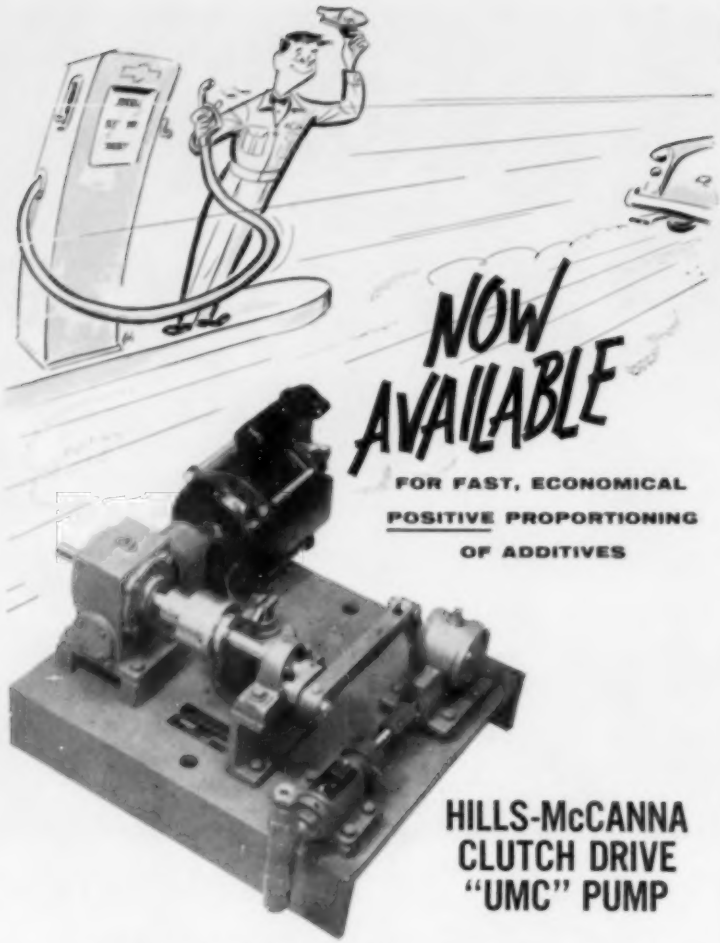
THE MIDVALE COMPANY- Nicetown, Philadelphia 40, Pa.

Offices: New York, Chicago, Pittsburgh, Washington, Cleveland, San Francisco

MIDVALE

FORGINGS, ROLLS, RINGS, CORROSION AND HEAT RESISTING CASTINGS

(To obtain more data on advertised products see page 916)



HILLS-McCANNA CLUTCH DRIVE "UMC" PUMP

If you're thinking of fuel additives or treatment, here's your chance to think of positive, dependable *and economical* metering to a flow.

Simplicity, economy and effectiveness are the basic principles of the "UMC" Pump. It is a clutch driven, positive displacement, solenoid actuated pump of the same high quality, design and workmanship found in *all* Hills-McCanna metering and proportioning pumps.

Available in capacities ranging from 0.05 gph to 24 gph per feed, the "UMC" operates at 60 strokes per minute at pressures from 125 to 5,000 psi. Pacing media, other than by positive displacement meter, are available. Installation of the "UMC" Pump is quick and simple; all parts are readily accessible for adjustment. Simplicity of design and common base mounting serve to ease what little routine maintenance is necessary.

Write for details today. HILLS-McCANNA CO., 2448 W. Nelson, Chicago 18, Illinois.

HILLS-McCANNA

metering and proportioning pumps

Also Manufacturers of:
SAUNDERS TYPE DIAPHRAGM VALVES
FORCE FEED LUBRICATORS • MAGNESIUM ALLOY SAND CASTINGS

ent sleeve materials are available for high temperatures and pressures. Standard valve sizes are 1 in. to 24 in. with sizes from 30 in. to 72 in. also available. Red Jacket Co., Inc., Investment Bldg., Pittsburgh 22, Pa.

Circle No. **58** *on Reply Card*

Automation Defined

. . . for the technical terms most broadly used: *Automation Dictionary* covers some 87 words and phrases, typical to automatic control, in simple terms. Brown Instruments Div., Minneapolis-Honeywell Regulator Co., Wayne and Windrim Sts., Philadelphia, Pa.

Circle No. **59** *on Reply Card*

Employee Training

. . . for both plant and supervisory personnel: handbook *How to Train, No. 4* considers the problem of training, when, what and who to teach, methods, steps in training, etc. Wheeler Associates, Inc., 15017 Detroit Ave., Cleveland 7, Ohio.

Circle No. **60** *on Reply Card*

Water Demineralizing

. . . by cation and anion exchange: 39-page *Handbook on Demineralizing* covers history of water treatment, definition of terms, comparison with evaporation, mechanical equipment details, exchange materials, different demineralizer and decarbonator arrangements, case histories, and photographs of actual plants. Cochrane Corp., 17th St. below Allegheny Ave., Philadelphia 32, Pa.

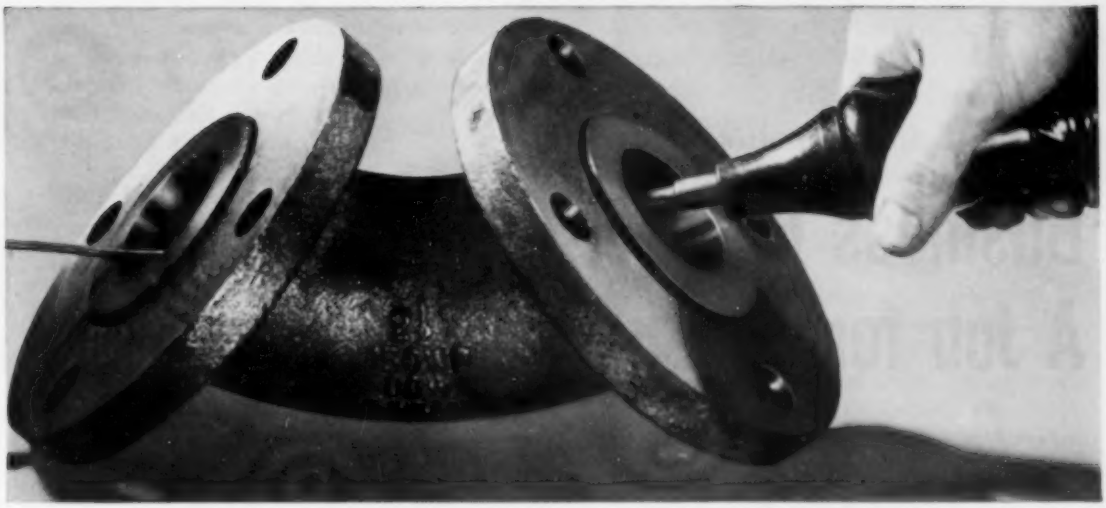
Circle No. **61** *on Reply Card*

Mechanical Seals

. . . are installed quickly in rotating equipment, and have complete interchangeability with stuffing-box packing in pumps, agitators, autoclaves, and other rotating processing equipment. The "Chempro Wedge-Lock" requires no special holding clamps, and no machining of stuffing-box faces to assure alignment. The seals have been used successfully for acids, caustics, solvents, other chemical liquids, and slurries that previously could not be sealed mechanically. The sealing faces are located inside the stuffing-box, reducing hazards in handling corrosive, toxic, explosive, and flammable liquids. Design is simple, consisting of eight parts. Installation and servicing can be handled in the field without special personnel. Chemical and Power Products, Inc., 11 Broadway, New York 4, N. Y.

Circle No. **62** *on Reply Card*

DOW



You can see why

SARAN LINED PIPE

KEEPS SHUTDOWNS TO A MINIMUM

It's made of corrosion-resistant saran pipe swaged into strong, rigid, nonbursting steel. And every piece is spark tested before you buy!

Unscheduled shutdowns are a thing of the past when you use saran lined pipe, fittings and valves to convey corrosive liquids. This modern, trouble-free piping is corrosion resistant . . . forms tight, snug, leakproof joints . . . won't burst under *working* pressures up to 150 psi. And every single piece of saran lined pipe is carefully spark tested by hand to be sure that there are no pinpoint holidays or cracks in its lining. Cast steel lined fittings are available for higher pressures.

Installation costs are surprisingly low with saran lined pipes, fittings and valves, too. They can be cut and threaded in the field with standard pipe-fitter's tools. Their rigidity means few supporting members are needed.

If you want to convey acids, alkalies, or other corrosive liquids at low over-all cost, be sure to investigate saran lined pipe. Contact the Saran Lined Pipe Company, 2415 Burdette Avenue, Ferndale 20, Michigan, Department SP528F.

RELATED SARAN PRODUCTS

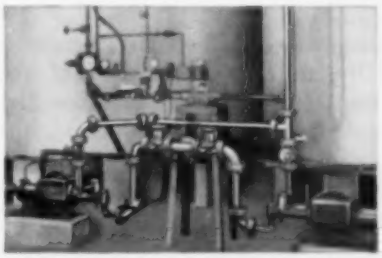
Tank lining • Saran rubber molding stock • Saran tubing and fittings • Saran pipe and fittings.

SOME OF THE MANY INSTALLATIONS USING

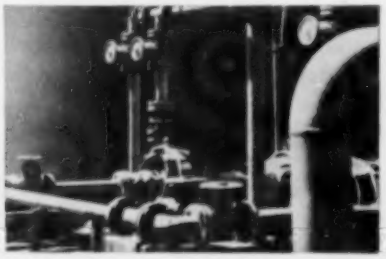
SARAN LINED

STEEL PIPE

Saran Lined Pipe is Manufactured by The Dow Chemical Company Midland, Michigan



A large Southeastern paper mill uses saran lined pipe to handle corrosive alum solution. It has proved to be an exceptionally satisfactory answer to eliminating unscheduled shutdowns.



This installation of a large Midwest company has conveyed highly corrosive hydrochloric acid for over seven years. The joints have remained as tight and leakproof as new.

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FINANCIAL AID TO HIGHER EDUCATION

Business Help for Our Colleges A Job for All Business Firms

IN recent months, individual business firms have announced the adoption of a variety of plans, both imposing and ingenious, for financial aid to higher education in the United States. In doing so, they have taken a lead in dealing with a problem of transcendent importance both to the business community and to our nation as a whole.

Previous editorials in this special series have shown that:

1. Our colleges and universities, and particularly the independent, privately endowed institutions, are in grave financial difficulties.

2. These difficulties promise to become much more acute in the years immediately ahead unless extraordinary steps are taken to relieve them.

3. A financially crippled system of higher education is a major national menace.

If, however, the business community is to play an adequate part in helping our colleges and universities financially, the plans adopted by business firms thus far constitute merely a beginning and a set of guide posts. What is required is a general movement on the part of business firms to go to the financial aid of higher education. Such a movement would involve a myriad of individual company plans which, in the nature of the case, cannot be expected to bring great renown or publicity to their sponsors.

Rescue Operation Is Feasible

For the business community as a whole it is feasible to make a major and possibly a decisive contribution to putting our colleges and universities back on their feet financially. One percent of business profits before taxes would do it. In 1954 business profits before taxes were about $35 billion. If one percent of these profits, or $350 million, were contributed to our independent, privately endowed colleges and universities it would enable these institutions (1) to increase the salaries they pay by $200 million a year, and (2) to provide $150 million more for modernization and maintenance of their establishments. In the opinion of competent authorities, this would put these institutions in relatively good working order financially, a process to which a matching grant of $50 million by the Ford Foundation for the improvement of faculty salaries will make a large contribution. It would add about one-fourth to their present annual outlay of about $1.4 billion.

Such a contribution from business would not meet the needs of the independent institutions for new buildings and equipment required to accommodate the great increase in college enrollment anticipated in the years immediately ahead. Neither would it relieve the financial problems of our tax-supported colleges and universities. As a group these institutions have fared better financially in recent years than the

independent institutions. But they also face grave financial problems, particularly in the provision of adequate faculty salaries. It would be far simpler, however, to solve the financial problems of the tax-supported institutions if the independent colleges and universities were back on their feet financially.

One Dollar Does Work of Two

The federal government exempts 5 percent of business profits from the tax imposed upon them if the 5 percent is devoted to religious, charitable or educational purposes. (Most profits are taxed 52 percent.) A contribution of one percent of business profits to higher educational institutions would exhaust only one-fifth of this allowance. It would bring to about two percent the total share of business profits going to both educational and charitable purposes.

In 1953, business firms contributed about $400 million, or slightly more than one percent of profits before taxes to educational and charitable purposes of all kinds. Of this total about $75 million went to educational institutions, mostly colleges and universities.

For some companies it is feasible to contribute more than the average contributed by business generally. Indeed, some companies not only utilize their full 5 percent of tax-deductible funds for charitable and educational purposes but go beyond it. For other companies in financial difficulties no contribution at all is possible.

If, however, those business firms for which it is financially feasible contributed one percent of their profits before taxes to our colleges and universities, the problem of adequate support for the crucially important business of higher education would be far along the way to successful solution. **In 1954 a contribution of one percent of their profits before taxes, or about $350 million, would have reduced business profits after taxes by only about half that amount. This would have meant a reduction of about $175 million, out of a total of about $17.8 billion of profits after taxes.**

Attractive plans to channel financial aid from business to higher education have been abundantly demonstrated recently. These plans, for the most part the creation of large corporations, have included not only a broad array of scholarship grants, but such ingenious arrangements as that by which a company matches with its funds the gifts its employees make to the colleges of which they are alumni.

A full array of these plans, some of which were discussed in an earlier editorial in this series, has been prepared by The Council for Financial Aid to Education (6 East 45th Street, New York City 17) and is available for the asking. Also, colleges and universities have established in most states and regions cooperative associations to help business help them. The Commision on Colleges and Industry (912 Kahn Building, Indianapolis 4, Indiana) distributes a directory of these associations. And, of course, the colleges themselves are always eager to discuss their financial problems with business people and suggest constructive solutions.

Only Small Start Made

The plans for business aid to education which have recently attracted national attention constitute the conspicuous sort of leadership which it is the privilege and opportunity of our great corporations to provide. But the job is too large to be handled by a small number of business firms, no matter how bold or ingenious their programs.

To put our colleges and universities back on a firm footing financially the help of the great rank and file of business corporations is required. All of them, large and small, have a crucial stake in seeing that this job is done. The future of America will be decisively shaped by what happens in and to our college classrooms.

This message is one of a series prepared by the McGraw-Hill Department of Economics to help increase public knowledge and understanding of important nationwide developments that are of particular concern to the business and professional community served by our industrial and technical publications.

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Donald C. McGraw

PRESIDENT

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EDITORIALS . . .

How Much Will You Import?

BY the time you read this piece the question of legislative restrictions on imports of crude oil and petroleum products will probably have been settled. At least it is now generally conceded that the oil producers and coal interests lost their fight, and that the final version of the new federal Reciprocal Trade Agreements Act will not include any limitation of petroleum imports.

In fact, when it came to a show-down in the Senate last month, supporters of the highly controversial Neely amendment, which would have imposed quota restrictions on petroleum imports, could not even muster enough support for a roll call and the amendment was defeated about 3 to 1 in standing vote.

Although the new bill does not include any specific restriction on petroleum imports, it does include a provision which makes it possible for the President to raise tariffs or impose quotas on imports of oil if he believes such imports threaten national security.

What constitutes a threat to national security is a moot point. A clue exists in the recent report of the President's Cabinet Fuels Policy Committee, which has recommended that imports of crude and heavy oil be held to a volume related to domestic crude production in the same ratio that such imports bore to such production in 1954.

But sticking with some such ratio is up to the individual petroleum importers. You have been successful in remaining free of governmental restrictions, in retaining the freedom of making your own decisions as to what and how much you import. Whether or not you will continue to have that freedom—and the flexibility in day-to-day operations it permits—is up to you and the way you use it. If you abuse it, even stronger demands for restrictive legislation will be raised than have been in the past.

Let's Get the Proper Yardstick

LAST month we pointed out on this page the industry's need for a bigger and better yardstick for measuring motor gasoline quality, a need which has been accentuated by the rapidity with which the 100-octane level is being reached.

You'll find more details on that problem in the lead story in this issue. That article, starting on p. 837, gives you some of the background information and explains what is being done to find a solution.

We don't profess to know what the final answer will be. But we do know that it is urgent to push through the revision of the antiknock rating value as promptly as is consistent with sound technical practice. Although 100 octane motor fuels aren't yet on the market, they are available in the laboratory, and different researchers even now are using different techniques for rating them. They have no commonly accepted yardstick for comparing their data on new fuels with that from other laboratories.

Commercial motor fuels in this range of antiknock values will probably be marketed within three years. The confusion resulting then from the lack of an accepted rating standard is hard to imagine.

Despite this urgency to provide a new yardstick, we should all recognize that we're going to have to live with whatever method or methods are adopted for a good many years. While at the same time that we urge the industry's technologists to move ahead on this problem as fast as is practical, we also caution them to give all suggested solutions sufficient thought and study to make sure we're getting the best available answers.

The Advance Man for Petroleum

A LONG and full career of service to the petroleum industry came to an end April 29 with the death of Dr. Gustav Egloff, research director since 1915 of Universal Oil Products Co.

Dr. Egloff's life was replete with notable achievements in the scientific world. He held 300 patents in this and other countries. He authored some 650 articles and technical papers. He held citations from many societies for his work in the advancement of science.

Perhaps his widest influence in the petroleum industry, however, came through his willingness—more than that, his eagerness—to talk up the industry on any and all occasions.

At a time when scientists were not encouraged to appear publicly outside their laboratories, as they are today, Dr. Egloff was telling of petroleum's growth and technological progress to all sorts of audiences. He was on the program at many meetings of oil men, and he appeared before many societies and numerous other groups outside the industry. He talked with enthusiasm in terms the layman could understand.

Dr. Egloff was also a showman, and knew how to capture the imagination of an audience. When synthetic fibers were first talked about, he presented himself in a suit made from synthesized materials that started out as petroleum fractions, and he announced this fact with great pride. He was the best press agent the industry has ever had.

His work in advancing technology in the petroleum field was of great importance, but here he was working in established scientific surroundings.

His pioneering in creating a role for the scientist outside the laboratory, in bringing an understanding of developments in research and invention to a far wider audience than his fellow scientists was equally important. For this Dr. Egloff should be honored as well as for his scientific achievements.

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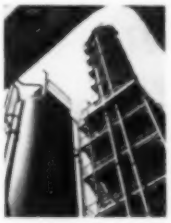

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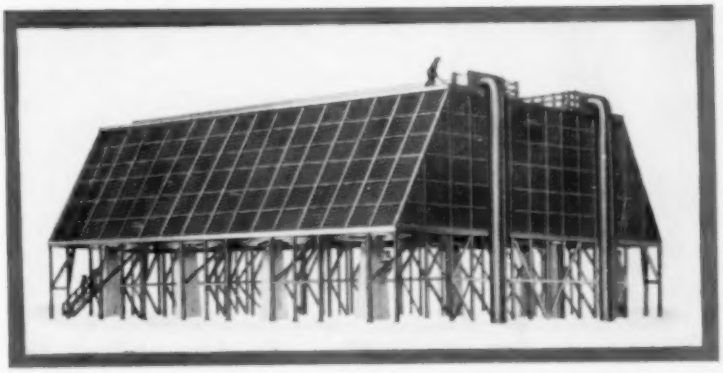

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